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COMMISSION ON SCIENCE AND TECHNOLOGY
FOR DEVELOPMENT
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Geneva, 15 May 1995
Item 4 of the provisional agenda

Information technologies for development

An issues note

Note by the UNCTAD secretariat

GE.95-50859

EXECUTIVE SUMMARY

The rapid advancement in information technology (IT) in recent years continues to transform the global economy through its effects on information processing, productivity and competitiveness. Technology advances and the low cost and miniaturization of microchips, a key component of information technology, have offered new opportunities in terms of access to and use of information technology. This has led to the spread of information technology in all aspects of social and economic activities in both industrialized and developing countries.

However, to date, the diffusion of IT in most developing countries and economies in transition has been slow, especially in the former. The reasons for this are different in the two cases. Whereas, in developing countries, particularly the least developed among them, the causes can be traced to lack of specific IT strategies and policies, low levels of technical personnel, lack of supporting infrastructure, lack of investments, and inability to keep pace with rapidly changing technology, in the case of the economies in transition, the problems are related to the need to improve and redeploy telecommunications and current information technology infrastructure and other resources from military to civilian use. Developing countries in general have the opportunity to leapfrog by acquiring information technology and pursuing an explicit policy in this field, provided they have the necessary infrastructure and institutional support, including the requisite skills.

The issues raised in this note are intended to assist the Commission on Science and Technology for Development in the consideration of its future work programme.

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Introduction

1. At its first session (12 to 23 April 1993), the Commission on Science and Technology for Development decided that, in addition to the panels for the three substantive themes for its second session, work in the area of information technology (IT), in particular with reference to the needs of developing countries, should be undertaken so that the Commission might consider it as a possible substantive theme for its inter-sessional period 1995-1997. This note attempts to identify some of the main issues in this area that might be considered by the Commission in the future. The note outlines the key features of information technology, its role in the newly evolving global order, some of the social, economic and legal implications of the diffusion of information technology and the constraints associated with its development and diffusion in developing countries. Finally, an attempt is made to identify some of the key issues that require further consideration.

Some key issues in information technology

2. For the purpose of this note, information technology refers to electronics-based technology which can be used to collect, store, process, package information and provide access to knowledge.1/ The pace of technological change in information technology in recent years has led to revolutionary changes in the processing and dissemination of data and to the emergence of an information society, with immense effects on production, services, cultural values, economic development, organization of labour, the environment and society as whole.

3. The market for information technology, however, remains geographically concentrated. According to one estimate, in 1993 the total world market for information technology amounted to $450 billion. Over 90 per cent of that market was concentrated in advanced industrialized countries, notably the United States (39 per cent), Western Europe (34.5 per cent) and Japan (29.6 per cent).2/ The share of four newly industrialized Asian countries and territories (Hong Kong, the Republic of Korea, Singapore and Taiwan, Province of China) was 1.5 per cent, while that of Eastern Europe was 0.8 per cent. The total for the rest of the world was 8 per cent.

4. In assessing the development and diffusion of information technology globally, three groups of countries may be distinguished: countries that are leaders in this field, including the production and generation of information technology, its application and diffusion (for example most of the OECD member countries); those where some capacity in the production and application of information technology (both hardware and software) has been developed but which, for the most part, still rely on imports from the first group for the diffusion of information technology (for example, several countries in Asia, some economies in transition and a number of countries in

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1/ It comprises, therefore, both the supply side (computer hardware and software as well as electronics-component industries) and the demand or user side (informatics applications in all economic sectors, information services industry, electronic publishing, broadcasting, and management information systems, for example).

2/ See, Yehia, Soubra, "Trends and current situation in the diffusion and utilization of information technology", in **Information Technology for Development, ATAS Bulletin**, issue 10 (forthcoming, 1995).

Latin America);3/ and those where the application of information technology is still in an embryonic stage and access to it depends solely on imports. It should be noted, moreover, that differences in accessing information technology exist not only between countries but also, and perhaps more importantly, between sectors and social groups within countries.

5. A core component of information technology is the semi-conductor chip which, since the early 1980s, has not only decreased in size and cost but has also increased steadily in capacity and complexity. 4/ These developments have enabled computers to evolve from room-size machines to palm-size devices. Moreover, the low cost and miniaturization of microchips have offered new opportunities in terms of access to and use of information technology. They have also led to the spread of information technology in all aspects of social and economic activities in both industrialized and industrializing countries. In manufacturing, and to some extent in agriculture, the introduction of information technology in designing, production processes and distribution has resulted in a drastic fall in costs, as well as improved technical performance. Recent advances in information technology systems have also enabled transnational corporations to transmit technical and economic information among numerous information technology systems at different geographical locations and involving widely dispersed industrial plants.5/ In this way, information technologies have created a symbiosis between development in the manufacturing sectors and that in the service sectors.6/ The effects of these developments on the international division of labour and production, as well as the globalization of the world economy, have been significant.

6. The application and diffusion of information technology must be seen in conjunction with the developments in telecommunications technology, in the sense that while information technology processes and packages information, telecommunications allow information technologies, to interact with other information technologies, as well as remote devices in networks, thereby permitting users to access databases and communicate with other users at long distances. The combination of information technology and telecommunications technology has greatly enhanced existing service industries and spun off

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3/ In some cases, the initial introduction of IT production capacity in these countries was the result of investment by advanced country firms to take advantage of low-wage locations, but deliberate policies have also been followed to build capabilities in IT and learn from locally based foreign firms through joint-venture arrangements and backward-linkaged activities.

4/ For example, the first electronic digital computer - the ENEAC, which was built in 1945 - weighed 5 tons, cost $5 million and had less processing power (10,000 instructions per second) than a microprocess or 5 millimetres square that costs less than $5 today.

5/ It is now common, for example, to design a product in one country, transfer the design electronically to another country for further development, assemble the product in a third country, package it in a fourth country, and finally market it in a fifth country. To do this, however, modern production requires a flexible system and strong links that mould design, management, production and marketing into one integrated system. This integrated system is realized through the application of IT, which provides the means for effective communication.

6/See, UNCTAD: Trade and Development Report, 1988, annex 5, "Technology issues in information services", pp, 257-262.

numerous new ones. It has increased the productivity, quality and efficiency of banking, business management, administration, education and health-care services. It has also allowed greater mobility and flexibility in capital and financial movements and "transborder data flows". 7/ It is this combination of information technology and telecommunications that has given meaning to the global information network and the development of a global information infrastructure (GII).

7. In a rapidly evolving world order, information is the ultimate currency of change that influences access to resources and the method and speed of delivery, enhances the efficiency of the production process, helps to improve trade and competitiveness, and facilitates the transfer, dissemination and application of technology.8/ The importance of access to information, as well as its efficient dissemination, is widely recognized in the industrialized countries and demonstrated by the new alliances that are being formed between Governments and enterprises in an attempt to strengthen their participation in the global information network.9/ A number of OECD countries have also developed a broad range of policies consisting of support for information protection, information technology production, diffusion policies to promote information technology use, and programmes to build common infrastructure and facilitate bridge-building between users and producers.10/ This contrasts with the situation in a number of developing countries, particularly the least developed African countries, where there are no national information technology diffusion policies and the infrastructure needed to facilitate regular flows of relevant information is

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7/ For an analysis of the rapid expansion of the services sector in general and data services in particular and the role of IT and telecommunications in transborder data flows, see Sauvant, Karl, **International Transactions in Services: The Politics of Transborder Data Flows**, the Atwater series on the World Information Economy, No. 1, Boulder, Colorado, and London, Westview Press, 1986.

8/ For an analysis of the importance of access to information for an efficient transfer and diffusion of environmentally sound technologies to developing countries, see "Experiences and problems faced by firms in developing countries in the transfer of environmentally Sound Technologies", a paper presented by H. Argalias at the Workshop on "**The Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies**", Seoul, Republic of Korea, 30 November to 2 December 1994.

9/ The Group of Seven ministerial conference on the development of a global information infrastructure (GII), which was held between 25 and 26 February 1995 in Brussels, is illustrative. The conference brought together ministers, business leaders and IT manufacturers from the Group of Seven industrialized countries to exchange views on the potential benefits of creating a GII and to discuss common approaches towards this objective.

10/ According to Hanna, for example, "technology diffusion programs in OECD countries are estimated to number over 1000, at a net total cost to governments averaging US$70 billion annually, about half of which is targeted directly or indirectly at information technology". See, Hanna, N, "information technology policies in industrialized countries: A shift towards diffusion", in **Information Technology for Development. ATAS Bulletin**, issue 10 (forthcoming, 1995).

limited.11/ According to one commentator, in Africa, information, is one of the "most expensive and scarcest resources".12/ At the present juncture, therefore, the global information network is neither truly global nor accessible to all.13/ Efforts towards remedying this imbalance would involve, among other things, accelerating the diffusion and application of information technology in developing countries.

8. The social and economic effects of the diffusion of information technology have attracted the attention of policy-makers in all countries. In this context, an issue of concern relates to the effects of information technology on employment. One view suggests that the diffusion of information technology would lead to a reduction in the demand for labour, thereby increasing the already high levels of unemployment. However, the available evidence is inconclusive, though two points merit attention: first, the scattered evidence available suggests that, at least in the industrialized countries, unemployment associated with the adoption and application of information technologies is relatively higher in the less-skilled than in the higher-skilled workforce - implying that the negative effects of information technology on employment is confined to specific skill categories; secondly, there is increasing recognition that the long-term positive effects of information technology on employment outweigh the negative short-term effects.

9. Most discussions on information technology focus on its important role in the creation and dissemination of information. Information technology enables the establishment of numerous databases at both the national and the international levels and provides linkages between them through networks. The databases available include information on diverse subjects. While some of these databases are in the public domain, others are privately owned. Moreover, most of these databases are in the industrialized North, where they are available "on-line" for anyone with a home computer and a telephone. Given the scarcity of information in a number of developing countries, therefore, the diffusion of information technology, combined with improvements in telecommunication services, could have a positive effect on the access of developing countries to information.

11/ See, for example, **UNIDO, Computers for Industrial Management in Africa: An Overview of Issues** (PPD.187), February 1991.

12/ See, Juma, C, "Environment, technology and international Trade: beyond financial additionality in Africa", prepared for the seminar on International Trade and Environment, Oslo, Norway, February to 1 March, 1991, p.9.

13/According to Martin Bangemann, the EU's Industry Affairs Commissioner, the development of a global information network will contribute to an easier integration of developing countries into the global economy. He has noted that: "New information and communication technologies, increasingly affordable as their costs, continue to fall, will help developing nations leapfrog entire stages of development in setting up their own infrastructures", and to achieve this "collaborative actions" involving developing countries will be essential. By the same token, the EU's President Jacques Santer has emphasized that: "Developing countries must participate in developments in information technology on an equal footing", because "it is a revolution of the whole planet, not only of the seven industrialized nations". See, "South-North Development Monitor", published by Third World Network in cooperation with Inter-Press Service and South Centre, 23 February 1995.

10. In industrialized countries, electronic mail and networks in general have allowed users to obtain better access to data banks located nationally and internationally. These services are slowly making inroads into developing countries, though at present, getting onto a network such as INTERNET requires investment in support services and efficient telecommunications systems, which are currently unobtainable in a number of developing countries.14/ For the foreseeable future, therefore, the need for investment in support services, as well as the low level of development of telecommunications systems in developing countries, may exclude some of these countries, particularly the least developed among them, from actively participating in the rapidly growing global information network. Thus, in the transition to the twenty-first century, the risk of greater marginalization of low-income economies and low-income social groups from the global information revolution is one important challenges that should be addressed by the international community.

11. The rapid changes arising from the gradual removal of trade barriers in many industrialized and developing countries, as well as countries in transition, have also enhanced the opportunities offered by information technology for efficient and lower-cost trading. Initiatives taken by UNCTAD in this area may help to illustrate the point further. In the recent United Nations National Symposium on Trade Efficiency, held in Columbus, United States of America, calls were made for measures to increase efficiency in international trade, reduce costs and barriers, and improve the participation of poorer countries in rapidly expanding trade and communications networks. To this end, the Symposium launched the Trade Point Global Network, which will consist of trade points located in various regions of the world interconnected in a worldwide electronic network and equipped with efficient telecommunications tools to link up with other global networks. The centralized network allows access to services required for international transactions. In effect, therefore, the "trade efficiency initiative responds to an urgent need to increase the international awareness and effective application of information technologies to trade".15/ A closely related service is the electronic trading opportunities (ETO) system, which provides subscribers worldwide with a single point of contact for their trade and business opportunities. 16/ The (ETO) system, also assist potential traders from diverse countries by matching the trading opportunities between them. Increasingly, therefore, information technology is playing a key role in facilitating trade efficiency and providing opportunities for developing countries to participate effectively in international trade.

14/ However, there are alternatives that are making access to international data-bases possible to many developing country computer users. FIDONET is such a programme. It is a low-cost method of linking computer bulletin board systems through ordinary telephone lines that allow users to overcome the constraints of utilizing the telecommunication systems during peak hours. The network systems automatically contact each other at night, when phone rates are low, to exchange conference postings and electronic mail messages.

15/ UNCTAD, "The trade point: concept and Implementation - note by UNCTAD secretariat", TD/B/WG.2/7/Add.1, 7 October 1993, p.3.

16/ The ETO service is supervised by the Special Programme for Trade Efficiency of the UNCTAD secretariat. The secretariat has also been responsible for the launching of the Automated System for Customs Data 8ASYCUDA), which is a data bank on customs regulations and procedures.

12. Management of the environment is another area which is mutually beneficial to both industrialized and developing countries and where the diffusion of information technology has had positive effects. Information technology enables the processing of a significant volume of scientific, social, geographic and demographic data. This potential, coupled with satellite imaging (remote sensing), could constitute a powerful tool for monitoring environmental degradation, as well as for a more rational exploitation of natural resources. 17/ Recent advances in information technology have also enabled scientists to monitor global environmental phenomena such as ozone depletion, deforestation, drought, desertification, land degradation, and natural resources exploitation. Moreover, through geographic information systems (GIS), it is possible to tackle the problems associated with rapid urbanization in developing countries.

13. From the perspective of the developing countries, the positive aspects of information technology are not only confined to the collection, processing and packaging of information on the environment but extend also to the organization and dissemination of this information "in a manner unique to one's requirements"18/ to meet the needs of users at different levels of development. Whereas in industrialized countries such information may be disseminated "on-line", in most developing countries, characterized by inadequate telecommunications facilities, accessing such information could be arduous, if not impossible. In such cases, one possible option for disseminating information is to use a high-data storage medium, such as CD-ROMS, that can carry picture, sound and text. Before that, however, major obstacles to accessing powerful information technologies need to be overcome.

14. Although the technological revolution in information technology and telecommunications has aroused much interest among policy-makers, the business sector, the media and the academic world in industrialized countries, little is known about the obstacles to accessing information technology and the diffusion and use of information technologies in developing countries, particularly the low-income economies. These issues, especially the impediments to the diffusion of information technology, need to be better understood. As noted above, apart from lack of information, a major obstacle to the diffusion of information technology in the developing world relates to inadequacy of telecommunications systems which are still in the early stages of development.19/ In many countries, high tariff structures imposed by telecommunications monopolies represent key impediments to the diffusion and use of information technology, there is therefore a need to examine the main deficiencies in the existing telecommunications systems and assess whether the corrective mechanism lies in the market system or in a combination of public and private initiatives.

15. Another factor that may hinder the diffusion and application of information technology in some developing countries is the proliferation of

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17/ For a review of information networks and systems on the environment, see "Mechanisms for the transfer of environmentally sound technologies and international cooperation", a paper presented by P. Roffe at the Workshop on **"The Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies"**, Seoul, Republic of Korea, 30 November to 2 December 1994. This paper also suggests that issues concerning the environment need to be brought to the forefront of the global information infrastructure agenda.

18/ See, Yehia, Soubra, op.cit, p.5.

19/ For a discussion on the concentration of telecommunications sector, see ibid, p.12.

standards. The existence of different information technology systems has meant that users become reluctant to invest in new systems that are incompatible with others currently installed in-house, as well as those used by partner firms - for example, subcontractors, equipment manufacturers and raw-material producers. The problems arising from the multiplicity of standards are compounded by the rapid rate of obsolescence due to technical change and the investments involved in support services.20/ The options for standardization, particularly at the national level, require further investigation.

16. The high cost of energy, the low capacity of the power-generation infrastructure, and the poor maintenance of power supply systems have also been major impediments to the application and diffusion of information technology systems in a number of developing countries. In many low-income developing countries, for example, there are frequent power supply interruptions and power surges large enough to cause serious damage to information technology systems and result in the loss of information.

17. As far as can be deduced from the available data, there appears to be a positive correlation between the rapid diffusion and application of information technology and the level of education, both general and technical. The experiences of the newly industrializing countries of Asia are illustrative. Some countries, for example Singapore, have demonstrated that, with a high level of general and technical education, "leapfrogging is possible and that countries could become advanced users of information technology without substantial information technology industrial capabilities."21/ A high literacy rate among the general population is essential, as well as the formulation of training programmes to improve computer literacy. In addition, people with special technical skills in computer sciences - for example, programming, data analysis, microcomputer processing and maintenance of information technology equipment - will also be required.

18. For developing countries wishing to accelerate the diffusion and application of information technology, investments in education in general and technical skills in particular are essential requirements. In some developing countries, particularly the least developed among them, literacy rates are as low as 27 per cent, as compared to over 90 per cent in the industrialized countries, the newly industrializing countries of Asia and certain economies in transition.22/ There is a need, therefore, for developing countries to invest in the upgrading of worker and management

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20/ See Yehia, Soubra, "Information technology and international competitiveness in construction services: opportunities and challenges", in **Information Technology and International Competitiveness: The Case of the Construction Services Industry**, United Nations: New York, 1993 (UNCTAD/ITD/TEC/6). Soubra explains that the reluctance of users to invest because of the incompatibility problem has " ..encouraged the formation of corporate ventures among IT companies that have hitherto been competitors; the motivations behind this move are to ensure increased systems compatibility and develop standards and innovative products and services at lower costs". See p, 27.

21/ Hanna, N. "Information technology policies in industrialized countries: A shift towards diffusion", in Information Technology for Development, ATAS Bulletin, issue 10 (forthcoming, 1995).

22/Human Development Report 1994, UNDP, New York.

skills through higher levels of formal education and specialized technical training. These skills can be provided partly by the formal education system and partly through in-firm training and autonomous training facilities provided jointly by business and government.

19. In brief, the revolution in information technology continues to transform the global economy through its effects on information processing, productivity and competitiveness. This revolution affects all aspects of society. As recently noted, the revolution ".. has only just begun, but already it's starting to overwhelm us. It's outstripping our capacity to cope, antiquating our laws, transforming our mores, reshuffling our economy, reordering our priorities, redefining our workplaces, invading our privacy, and shifting our concept of reality."23/ There is a consensus that the transition to the twenty-first century will witness a quantum leap in the development and exploitation of information technologies, with corresponding ramifications for social and economic organization, the environment, culture and the development of a global information infrastructure. The key issues of concern to policy-makers and international organizations are the extent to which this major transformation has benefited all aspects of society and the ways and means of achieving a truly global information infrastructure. Thus, it is timely for the United Nations Commission on Science and Technology for Development to give greater attention in its future work programme to the opportunities offered and challenges posed by the rapidly evolving information society.

Issues for further consideration

20. In setting the framework for the diffusion and application of information technology, countries need to take into account the rapid changes that are taking place in this field at the international level. Issues arising from different modes of technology transfer, property rights, standards of information technology systems, and globalization have a bearing on national actions. Moreover, efforts at the national level to enhance the diffusion of information technology need to consider the sectors in the national economy in which information technology is likely to play a significant role. More specifically, the following issues may require further exploration:

(i) The social impacts of the diffusion of information technology. In the area of employment, one needs to assess the impact of information technology in both the short and the long term. This issue is particularly pertinent for developing countries, where unskilled labour is in abundant supply. It is essential to investigate the skill requirements for information technology diffusion and also the effects of this diffusion on the skill and gender composition as well as on the organization of the workforce in the workplace. How can training and retraining activities be organized to stimulate information technology diffusion and reduce the possible immediate adverse effects of information technology on employment?

(ii) The institutional and infrastructural requirements for the diffusion of information technology in developing countries. Actual information needs, existing infrastructure, including telecommunications and power supply, local information resources and technological capabilities should be assessed and conditions for their improvement discussed. In this respect, it is important to ask what the effect will be of the development of a global Information Infrastructure on countries which - because of various infrastructural deficiencies such as poor telecommunications systems and the high costs of the service - will not be able to make use of it. Also, what are the key institutional and administrative structures necessary for the diffusion of information technology?

23/ See, "Technology 1995: The hype and the Hope", Newsweek, special issue on information technology, 27 February 1995.

(iii) The proliferation of networks and the legal implications involved, particularly regarding privacy, security of information and proprietary issues, need to be examined. As the potential increases for information technology to secure and manipulate detailed information, the demand for the protection of individual privacy and a company's confidential data is likely to increase. How, therefore, can the privacy of the individual with regard to personal data processing be protected? The revolution in information technology poses great challenges to the traditional forms of protection. The relevance of existing proprietary norms to the new technologies, particularly information technology, needs to be explored. Do the recent revolutionary changes in information technology require changes and new approaches to the traditional forms of legal protection? In this respect, is it relevant also to explore the effects of the new intellectual property structure emerging as part of the Uruguay Round on the development, transfer, diffusion and application of information technology in developing countries? Another important issue which requires further exploration concerns the implications of the multiplicity of standards for the expansion of low-end networking and the diffusion and application of information technology in developing countries;

(iv) The appropriate approaches to the diffusion and application of information technology, particularly in developing countries, need to be further explored. The diffusion of information technology can be achieved through market mechanisms and/or policy intervention. The latter can be divided into two categories: general policy and a selective approach. Although these two approaches to policy intervention can be complementary, they reflect different development objectives and different perceptions of the effects of policies and markets. The implications of the various approaches to the diffusion of information technology on competitiveness and the accumulation of technological capabilities need to be analysed. Furthermore, the options of selective strategies and a general policy for diffusion of information technology require further investigation. Which of these approaches is better suited to developing countries? Under what conditions could combinations of these approaches be useful? What are the merits and demerits of pursuing these approaches for low-income developing countries?

(v) Given the different levels of technological advancement of developing countries, there is a need to identify the areas/sectors where information technology can be effectively utilized to enhance the comparative advantage of the countries concerned. In the case of some economies in transition, the key issue is how to convert existing information technology capability in military-related industries - in terms of both technical personnel and physical infrastructure -- into civilian uses. In most developing countries, attention should be given to the actual and potential benefits of information technology diffusion in public administration and public services. In this connection, an issue of relevance to the science and technology community relates to the potential role of information technology in the transfer and diffusion to the developing world of technologies in the public domain. The options for facilitating such transfers through international cooperation need to be explored.

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Information technologies for development

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Note by the UNCTAD secretariat

Corrigendum

Footnote 16 on page 8 should read as follows:

16/ The ETO service is supervised by the Special Programme for Trade Efficiency of the UNCTAD secretariat. The secretariat has also been responsible for the launching of the Automated SYstem for CUstoms DAta (ASYCUDA), which is a computerized customs management and clearance software and which contains a data bank on customs regulations and procedures. ASYCUDA is available to member States, free of charge, within the context of a technical cooperation project for customs reform and modernization.

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An issues note

Note by the UNCTAD secretariat

Corrigendum

Paragraph 3, line 5 For Western Europe (34.5 per cent) and Japan (29.6 per cent) read Western Europe (34 per cent) and Japan (16 per cent)

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ACTION ARISING FROM THE FIRST SESSION: FINAL REPORT OF THE AD HOC WORKING GROUP ON THE INTERRELATIONSHIP BETWEEN INVESTMENT AND TECHNOLOGY TRANSFER

Note by the UNCTAD secretariat

Economic and Social Council resolution 1993/69 requests the Secretary-General of the United Nations Conference on Trade and Development to submit to the Commission on Science and Technology for Development at its second session a report on the results obtained from the Work of the Ad Hoc Working Group on the Interrelationship between Investment and Technology Transfer.

Pursuant to that resolution, the final report of the Working Group is being circulated to the Commission (TD/B/40(2)/17).

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Item 6 of the provisional agenda

CONSULTATIVE MEETING ON A COALITION OF RESOURCES FOR SCIENCE AND TECHNOLOGY FOR DEVELOPMENT

Note by the UNCTAD secretariat

Pursuant to Economic and Social Council resolution 1993/73 and General Assembly resolution 48/179, the Consultative Meeting on a Coalition of Resources for Science and Technology for Development was convened from 1 to 2 December in New York. The report of the meeting is attached to this note.

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COMMISSION ON SCIENCE AND TECHNOLOGY
FOR DEVELOPMENT

Second Session

REPORT

Consultative Meeting on a Coalition of Resources for Science and Technology for Development

NEW YORK, 1 - 2 DECEMBER 1994

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I. Introduction

The Consultative Meeting on a Coalition of Resources for Science and Technology for Development was convened on 1 December, 1994 at 10:00 a.m. in the Trusteeship Council. Mr. Sergio de Abreu e Lima Florêncio, Minister of the Permanent Mission of Brazil to the United Nations acted as Chairman of the meeting. The meeting followed the Agenda outlined in Annex I. The participants, as listed in Annex II, represented a range of organizations, including bilateral donors, multilateral organizations, private foundations, funding and scientific organizations. The Consultative Meeting held three sessions, concluding its work on 2 December.

The Consultative Meeting was convened in response to ECOSOC resolution 1993/73, and General Assembly resolution 48/179, which welcomed the initiative for a consultative meeting to consider ways and means for organizing a coalition of resources and urged that national efforts and international development cooperation, be intensified and strengthened towards endogenous capacity-building in science and technology in the developing countries.

The Consultative Meeting was opened with introductory remarks by Mr. Nitin Desai, the Under-Secretary-General for Policy Coordination and Sustainable Development. He explained that the consultative meeting was intended as an exchange of ideas to crystallize the notion of a "coalition of resources". He noted the importance of having a clear concept of science and technology as basic to mobilizing and coordinating resources. In this regard, a mission-specific approach is particularly helpful. The efforts at the global level should be of a catalytic nature but the greater part of capacity building in science and technology has to take place at the national level. Science and technology is embedded in sectoral activities. Coordination must thus be built around specific themes rather than on science and technology in general. He stressed the need to be eclectic and elastic in the choice of partners in promoting science and technology both at the national and international levels in a situation of shrinking resources. Transition to sustainable development requires above all a systematic approach to science and technology. He looked forward to the ideas that would emerge from meeting and said they would be actively pursued and followed-up.

The list of documentation, along with a discussion paper, to be considered by the meeting was reviewed by the secretariat. The list of documentation is contained in Annex III.

It was emphasized that the purpose of the meeting was to generate ideas and that the concept of a coalition of resources was not limited to finances, but included human and intellectual resources and logistic services that might be available to assist developing countries.

II. Summary of Presentations

To facilitate a discussion of possible models for coordination of science and technology, presentations of five existing examples of coordination at the national and international level were made. These ranged from rather informal, collegial means of coordination such as the "like-minded donors" approach to more structured mechanisms such as "Bellanet" which is just being initiated. All of these examples provided useful elements that could be considered in the context of devising a mechanism for coordinating and making more effective use of existing resources for science and technology.

A. "Like-Minded Donors"

Mr. George Waardenburg, Dutch Ministry of Foreign Affairs, explained the dynamics of this group which consists of: IDRC (Canada), DANIDA (Denmark), SAREC (Sweden), MNFA/NORAD (Norway) and DGIS (The Netherlands). "Like mindedness' was characterized as: (1) looking at development from an international view point, (2) recognition that it is essential to listen to developing countries, (3) the straightforward implementation of ideas into practice, and (4) the recognition of the importance and complexity of science and technology issues. .The collaboration between "like minded donors" was likely to result in: a better understanding for the needs of developing countries, the encouragement and stimulation of colleagues and the adjustments of strategic policies and cooperation at the operational level.

B. Bellanet

Mr. John Hardie, International Development Research Center (IDRC), Canada. Bellanet is to be a global forum for sustainable development research and capacity development. Its objectives are to: (1) improve donor performance in programme planning, implementation and evaluation, through better sharing of ideas, information and experience; (2) to promote and achieve more concerted efforts and financial collaboration; and, (3) improve cost-effectiveness, impact and relevance of both individual agencies and the overall donor community, by improved synergy and/or more effective division of labour. The change of title from "Donornet" to "Bellanet" reflects the intention to create an inclusive network of donors, development agents and partners in developing countries. A special group of representatives from developing countries will advise the project on the information networking needs of client and recipient communities. The project begins a three-year experimental phase in January 1995.

C. Coordination of Science and Technology Policies in Africa

Mr. Akin Adubifa, Carnegie Corporation of New York noted that coordination in this area is organized through the African Technology Policy Studies Network. The mission of the Network is to improve the quality of technology policy making in sub-Saharan Africa and to strengthen the region's institutional capacity for the management of technological development. This is pursued through the creation of a strong sense of ownership in the countries by encouraging them to set their own research agenda and through peer review of research activities. He noted that the number of donor agencies willing to support the initiative financially was gradually expanding and suggested that a key factor in the success of the network so far is the structure of partnership which involves and allocates responsibilities to donors, researchers, policy makers and programme coordinators.

D. Endogenous Capacity Building at the National Level

Mr. Johann Baumler (UNDP) and Mr. Lutz Baehr (DDSMS) presented the U.N. experience with coordination of science and technology at the national level through Endogenous Capacity Building. There are five existing mechanisms for overall coordination used by UNDP: country programming, round tables, technical assistance assessment schemes, strategic notes and sector reviews. The lessons learned from the pilot programme on Endogenous Capacity Building through National Policy Dialogues include: (1) the need to mobilize external and domestic resources; (2) using a systems approach to capacity building; (3) the ongoing process of national dialogues should be part of any coalition of resources; (4) mechanisms of coordination should be focused on endogenous capacity building.

E. CGIAR

The experience of the Consultative Group on International Agricultural Research (CGIAR) cooperation scheme was presented by Mr. Callie Boucher, World Bank Liaison Office. The Group is a partner in a global agricultural research system which includes: national agricultural research systems (NARS) of developing countries, sixteen international agricultural research centers (IARCs) of the CGIAR and advanced research institutes in both developed and developing countries. The CGIAR plays three roles: (1) to generate research products, both information and materials, which are useful to the farmers in a wide range of developing countries; (2) to provide a bridge with developed country research capacity to focus on the critical problems of developing country agriculture and the environment; and (3) to help build scientific capacity in the national agricultural research systems in developing countries. Three types of mechanisms are used: (a) collaborative research, (b) networks, and (c) consortia. The strengths of this coordination scheme include: its apolitical nature, the use of a technical advisory commission, donor sovereignty and vesting autonomy in each center which sets its own priorities.

III. Topics Discussed

A. Definition and Classification of Science and Technology

The issue of defining science and technology was introduced to better understand what type of projects and programmes might be classified under this rubric given the variety of categories currently used by donor agencies. This is a functional requirement based on the need for information collection and comparative analysis and to help make science and technology efforts more visible. However there is a strategic concern to make science and technology more relevant to specific needs of developing countries. It would be difficult to agree on a coalition of resources for science and technology unless there is clear understanding of what is meant by science and technology in that context.

The participants at the Consultative Meeting were not in a position to define science and technology for the purpose of standardizing the data bases of donor organizations. This would require specialized expertise. The modalities for undertaking such an exercise might best be considered by a small working group under the aegis of the Commission on Science and Technology for Development. However, the terms "science and technology," should be demystified, and its scope be understood to include the natural, physical and social sciences. Science and technology are often seen as based on developed country value systems or as something that is excessively intellectual and outside the range of regular citizens. The challenge is to teach people to employ science and technology as tools to transform their daily lives and raise their standards of living, while recognizing at the same time the value of existing local knowledge systems.

Mobilization of national intellectual resources through identification and investment in existing scientific and technological talents in the countries, was considered critical for strengthening the knowledge base in those countries. This is the reasoning behind the approach of some donors who consider endogenous capacity building as a means of empowerment through knowledge. Such efforts extend beyond the traditional training of high level academic specialists and include new initiatives to break down science illiteracy and raise public awareness of the importance of science and technology for development.

Technological innovation alone cannot go far without being accompanied by: (1) the presence of a strong political will at the highest level; (2) the necessary social and organizational innovation; and (3) a receptive cultural base to support technological innovation. Capacity building in this context would also mean building decision making and managerial capabilities.

B. Coordination Arrangements and Mechanisms

Coordination arrangements must be based on user/recipient needs and demands. There was general agreement that greater commonality of action among donors in terms of better focusing and concentrating assistance would be beneficial provided such commonality of action was demand driven, taking into account individual donor mandates. The analogy was made to a sports team where the individual desire to excel has to be harnessed to the team effort in order to win. Both individual excellence and team spirit are essential.

It would not be useful to try to organize a single global coalition of resources for science and technology. There should be multiple coalitions focused around specific themes. Coalitions of resources

or any type of donor coordination mechanism would have to be informal and cooperative in nature and would have to be focused on specific, well defined types of science and technology related themes, sectors, programmes and projects, rather than on science and technology in a generic sense. It is the informality and voluntary nature of the CGIAR experience that was identified as contributing to its success as a coordinating mechanism for funding research activities.

The programmatic framework for a coalition of resources would have to be built on a clear understanding of the focus of such an undertaking. One possible focus would be "building science and research capacity to generate knowledge and technology for development." In this regard, the following four areas could serve as general organizing principles for assistance efforts:

(1) Policy development for promotion of national capacity to provide a policy environment that will foster the use of science and technology for development, including priority setting;

(2) Identification and investment in locally available technical and scientific talent;

(3) Support for national institutions responsible for implementing science and technology programmes; and,

(4) Ensuring sustainable funding

Any one of these elements could be used as a basis for focusing the activities and assistance of a particular donor or agency.

At the national level, coalitions could be based on continuing policy dialogues with a wide range of stakeholders, including the private sector and the public at the grassroots level. Existing institutions in the countries could play the role of facilitator for these coalitions.

The focus could be placed on programmes directed for instance at: (1) certain themes derived from demand assessment in developing countries; (2) sectors chosen on the basis of similar assessment; (3) specific country studies reviewing the existing science and technology system including the structure for the expression of needs and indication of opportunities for improving the S&T system; (4) inter-country programmes at the regional level, coordinating the research efforts in the constituent countries, like the African Economic Research Consortium.

C. Role of the Commission on Science and Technology for Development

The existing coordination schemes for donors in science and technology are organized on an *ad hoc* basis without an umbrella mechanism. The funding of science and technology related activities is largely left to a spontaneous "market" of donors. While these informal networks of donors should be encouraged, there would be a value in having a periodic exchange of experiences among partners of different networks through a political forum such as the CSTD. It would be also worth studying experiences and approaches that have proven successful or that have encountered problems. The CSTD may usefully consider devoting some part of its biennial meeting, or develop an intersessional activity to provide a forum of such interaction with and among donors and other partners.

CSTD may also wish to consider setting up a small task force to examine the possibility of

arriving at clear categories for classifying science and technology activities so as to facilitate the future collection and analysis of data.

The private sector has a potentially important and significant role to play in the development and encouragement of science and technology capacity. Its role should be assessed in more detail with the view to involve them in future interactions among partners of development.

IV. Recommendations

(1) At the international level, there should be multiple coalitions focused around specific themes and common goals amongst donors and recipients. These should be based on voluntary and informal mechanisms that promote the full interaction of both donors and recipients. The feasibility of building science and technology into existing and broader coordination schemes should be considered.

(2) At the national level, coalitions should be based on continuing policy dialogues with a wide range of stakeholders, including the private sector and the public at the grassroots level.

(3) CSTD should provide a forum for exchange of views and interaction among partners of different networks and coordination schemes in the area of science and technology for development. Such forums may be held either as a segment of its biennial sessions or as an intersessional activity.

(4) CSTD may also wish to consider setting up a small task force to examine the necessity for and the possibility of arriving at clear categories for classifying science and technology activities so as to facilitate the future collection and comparative analysis of data.

(5) The private sector has a potentially important and significant role to play in the development and encouragement of science and technology capacity. There is need, however for a more detailed assessment of the actual and potential contribution of the private sector to science and technology and CSTD should be requested to undertake such assessment as part of its work programme.

Annex I Agenda

I. Opening session

Welcome and introductory remarks
by Under-Secretary-General of the Department for Policy Coordination and Sustainable Development

II. Introduction of the background paper by the Secretariat

III. Review of existing coordination schemes

A. Coordination group among "like-minded donors" for research: presentation by Directorate General for International Cooperation of Netherlands

B. CGIAR cooperation scheme: presentation by the World Bank

C. Bellanet model: presentation by IDRC

D. Coordination on science and technology policies in Africa: presentation by the Carnegie Corporation of New York

E. Coordination in science and technology at the national level through Endogenous Capacity Building approach: presentation by UNDP

IV. Proposals for improved coordination

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(UNESCO)

Karel Zebrakovsky
Permanent Mission of the Czech Republic to the United Nations

Annex III List of Documents

- Consultative meeting on a coalition of resources for science and technology for development, New York, 1 - 2 December 1994, discussion paper.

- Report of the Secretary-General on Division of labour and coordination within the United Nations system in the field of science and technology (E/1994/70).

- Excerpts from the report of the Economic and Social Council at its substantive session in 1994 (A/49/3), Chapter III, section A. Science and technology for development.

- Excerpts from the report of the Administrator on United Nations Fund for Natural Resources Exploration, United Nations Fund for Science and Technology for Development and Transfer of Technology Through Expatriate Nationals (DP/1994/29).

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Item 7(a) of the provisional agenda

SCIENTIFIC AND TECHNOLOGICAL ASPECTS OF SUSTAINABLE DEVELOPMENT
Progress achieved and problems encountered in the application of science and technology for sustainable development

Report of the Secretary-General

SUMMARY

The present report provides an overview of the progress made in the imlementation of three main Chapters of Agenda 21 dealing with science and technology for sustainable development, including a summary of actions taken so far by CSD.

Chapter 16 on environmentally sound management of biotechnology, focuses upon the need for (a) increasing the availability of food, feed and renewable raw materials; (b) improving human helath; (c) enhancing protection of the environment; (d) enhancing safety and developing international mechanisms for cooperation; and (e) establishing enabling mechanisms for the development and the environmentally sound application of biotechnology.

Chapter 34 dealing with issues related to the transfer of environmentally technology, cooperation and capacity-building, has been focused on three programme areas: improving access to and dissemination of information on environmentally sound technologies; capacity building for managing technological change; and promoting technology cooperation and partnerships.

Chapter 35 covering issues related to science for sustainable development, addresses them in terms of strengthening the scientific basis for sustainable development; enhancing scientific understanding; improving long-term scientific assessments; and building up scientific capacities in all countries.

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II. AGENDA 21 CHAPTERS HAVING STRONG COMPONENTS OF SCIENCE AND TECHNOLOGY

III. REFERENCES

I. INTRODUCTION

1. The Commission on Science and Technology for Development (CSTD), at its first session in April 1993, stressed the importance of helping developing countries and countries with economies in transition to harness the potential of science and technology to achieve the objectives set forth by the United Nations Conference on Environment and Development. In this context, the CSTD decided, in resolution IV, to place particular emphasis in its work on policy issues and options related to the development, transfer and utilization of technologies that promote sustainable development objectives, in accordance with the mandate of the Commission and taking into account the provisions of Agenda 21 concerning science and technology.

2. This decision of CSTD is also in line with the recommendation made by ECOSOC at its coordination segment in 1994[1], which urged that the work programmes and schedules of CSTD and the Commission on Sustainable Development (CSD) be better harmonized in order to avoid duplication and enhance complementarities and thus increase their effectiveness. ECOSOC further suggested that CSTD should take into account the ongoing work of CSD in designing its future work programme.

3. Agenda item 7 (a) of the CSTD's second session reflects the above decision and called for a report of the Secretary-General on the results and problems related to the application of science and technology for sustainable development.

4. The main chapters dealing with science and technology in Agenda 21 are: Chapter 16 - Environmentally sound management of biotechnology; Chapter 34 - Transfer of environmentally sound technology, cooperation and capacity-building; and Chapter 35 - Science for sustainable development, although implications for science and technology are spread throughout Agenda 21. Implementation of these three Chapters is the focus of this report, since they are of particular relevance to the work of CSTD.

5. In the course of its first three sessions, the CSD reviewed other chapters dealing with sectoral and cross-sectoral issues. Among them, those of relevance to science and technology are listed in Annex II. The CSTD may also refer to the report of the Panel on Science and Technology for Integrated Land Management (E/CN.16/1995/4) which presents policy issues and options for applying science and technology to integrated land resources management (Chapter 10 of Agenda 21).

6. Much of the documentation for CSD sessions are prepared on an inter-agency basis. The Inter-Agency Committee on Sustainable Development (IACSD) set up in 1993 for inter-agency coordination in relation to Agenda 21, has

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[1] Agreed conclusions on Coordination of the Policies and Activities of the Specialized Agencies and Other Bodies of the United Nations System related to Science and Technology for Development (Agreed conclusions/1994/1) in the Report of the Economic and Social Council at its forty-ninth session (A/49/3).

designated task managers from different agencies. One of the roles of the Task Manager is to prepare, in collaboration with concerned organizations, coordinated inputs for the consolidated analytical report of the Secretary-General which focuses on common United Nations system strategies for the implementation of Agenda 21 and identifies areas for further action for consideration by CSD. Other roles of the Task Manager relate to promoting information exchange and inter-agency contact, and catalyzing joint activities and programmes. The Task Manager system has facilitated collaborative
monitoring and reporting on the progress made in implementing Agenda 21. UNIDO is the Task Manager for Chapter 16; DPCSD is the Task Manager for Chapter 34; and UNESCO is the Task Manager for Chapter 35. Chapter 34 has been reviewed by CSD on a yearly basis, while Chapters 16 and 35 are being reviewed in 1995 only.

7. One problem in monitoring progress in the implementation of Agenda 21, and Chapter 34 in particular, has been the difficulty in obtaining accurate information and statistics on current trends. Reporting to CSD has relied on national reporting by Governments on the specific themes under review. Trends in technology transfer, particularly through foreign direct investment have been difficult to assess because information on the investments of private companies is difficult to secure. It was also difficult to report on activities related to science for sustainable development, as very little information was provided in national reports. A problem in monitoring Chapter 16 seems to be the existence of diverse and sometimes isolated efforts.

II. SCIENCE AND TECHNOLOGY IN AGENDA 21

8. Chapter 16 focuses upon the need for (a) increasing the availability of food, feed and renewable raw materials; (b) improving human health; (c) enhancing protection of the environment; (d) enhancing safety and developing international mechanisms for cooperation; and (e) establishing enabling mechanisms for the development and the environmentally sound application of biotechnology. These five programme areas seek to foster internationally agreed upon principles to be applied to ensure the environmentally sound management of biotechnology, to engender public trust and confidence, to promote the development of sustainable applications of biotechnology and to establish appropriate enabling mechanisms to achieve those objectives.

9. Chapter 34 of Agenda 21 focuses on the transfer of environmentally sound technology (ESTs). ESTs are considered total systems which include know-how, procedures, goods and services, and equipment as well as organizational and managerial procedures. Environmentally sound technologies are also supposed to be compatible with nationally determined socio-economic, cultural and environmental priorities. The activities proposed in this chapter aim at improving conditions and processes on information, access to and transfer of technology (including the state-of-the-art technology and related know-how), as well as on capacity-building, financial arrangements and partnerships.

10. Chapter 35 of Agenda 21 focuses on the role and the use of the sciences in supporting the prudent management of the environment for the daily survival and future socio-economic development of humanity. One of the roles of science cited in the Chapter is to provide information to better enable formulation and selection of environment and development policies in the decision-making process. In order to fulfill this requirement, Chapter 35 proposes activities aimed at strengthening the scientific basis for sustainable development, enhancing scientific understanding, improving long-

term scientific assessments, and building up scientific capacities in all countries.

11. In other chapters, particularly those dealing with sectoral issues, science and technology are considered as means of implementation, along with capacity-building, human resource development and financing.

III. ENVIRONMENTALLY SOUND MANAGEMENT OF BIOTECHNOLOGY (CHAPTER 16)

12. Since UNCED, considerable progress has been achieved in raising awareness among scientists and policy makers, with the result that several developing countries now give high priority to biotechnology development. Developed countries, having increasingly privatized biotechnology research and development, continue to forge rapidly ahead in all sectors, expanding from the pharmaceutical and health sector to the agriculture sector, with a development trend towards the environmental sector.

13. However, many constraints to biotechnology development, diffusion and applications still remain. Such constraints exist in developed countries and, even more so, in developing countries, mostly as a result of slow progress on issues of biosafety regulatory arrangements and intellectual property protection with respect to biotechnology. In addition, financial support for capacity building in developing countries has remained small, depriving developing countries of opportunities to build the critical mass to allow them to benefit from emerging new biotechnologies.

14. As biotechnology continues to make rapid scientific and technological advances, there are increasing gaps in countries' abilities to benefit. Various United Nations agencies and international organizations have taken early initiatives to meet the challenge of the situation and have been actively involved in working with biotechnology and issues related to it.

15. Various United Nations agencies have continued to strengthen their biotechnology and related support programmes and to develop new biotechnology initiatives to assist developing countries. Programmes range from creating awareness to policy formulation to capacity building. Several mechanisms have been introduced, including the establishment of several new scientific institutions and networking arrangements at the national, regional and international levels. Although international biotechnology initiatives and efforts have been fairly distributed to a certain extent among the various regions, countries in Asia and Latin America have advanced in initiating national programmes in biotechnology, either in the form of a new programme or by expanding traditional biotechnology programmes that integrate genetic engineering technology into education and research and development.

16. In general, a limited number of developing countries have made important and, in some cases, rapid progress in enhancing their capacity to generate, adapt, integrate and diffuse biotechnology, both individually and through the various networking arrangements being increasingly promoted.

17. To meet the accelerating demands of a growing worldwide population, the challenge lies not only in increasing food production, but also in significantly improving food distribution systems. Efforts to meet these challenges will be through the successful and environmentally safe application of biotechnology in agriculture with a long-term commitment.

18. Increasing levels of environmental degradation compounded by poor and inadequate development continue to impact negatively on human populations. International efforts have been enhanced in making the uses of biotechnology

in combating major communicable diseases, in promoting health, in improved programmes for treatment and protection from major non-communicable diseases, and in developing appropriate safety procedures. Biotechnology products in health care are now fairly widespread.

19. Of urgent need is the prevention, halting and eventual reversal of the effects of environmental degradation through the safe use of biotechnology. International organizations are promoting production processes that make optimal use of biotechnologies for the rehabilitation of land and water, waste treatment, soil conservation, reforestation and afforestation.

20. A policy issue that requires further attention is that of biosafety. Developing countries and NGOs have expressed concern that private companies might conduct clandestine, indiscriminate field testing of genetically modified organisms in developing countries. Due to a combination of factors, including inadequate financial resources and a lack of understanding of the need for proper biosafety measures, safe laboratory practices are not followed in many R and D facilities where new biotechnology researchers are venturing into emerging areas of genetic engineering technology. For similar reasons, it is difficult for less advanced developing countries to determine and/or prioritize the need for appropriate biotechnology-related tools for research and development as well as for useful practical applications. At the present time, the absence of established biosafety procedures in developing countries constitutes a major constraint to field testing and product development.

21. The experience of UNIDO (Technology and Investment Partnership Initiatives) and others concerned with transfer and development of biotechnology within developing countries indicates that the successes were based on strategic alliances with institutions in developed countries either at the development stage or at both research and development stages. Such strategic alliances might involve public institutions or the private industrial sector, or might involve both. One common factor in most cases was the involvement and participation of an intermediary organization, often with financial and/or technical support. The role of intermediary organizations should be further studied and evaluated as a candidate for future use.

22. In most developing countries, public institutions are the main centres where research is being done in the emerging biotechnologies. Entrepreneurs and industry in many of these countries have still to gain confidence in the potential of investing in commercializing results emanating from the research laboratories.

23. The work of the international biotechnology programmes of United Nations agencies and of organizations such as the OECD Development Centre concerned with the introduction of new technologies into agriculture shows that the extent to which countries can take advantage of new technology will depend on national conditions and policies. External cooperation can facilitate technology development and diffusion, but can only complement - not be a substitute for - national efforts, capacities and policies. It has become clear that biotechnology must not only be understood but also appreciated by policy-makers for it to be closely integrated with other priorities and policies: science and technology, agriculture and agricultural research.

24. Although the new biotechnologies emerged almost two decades ago, the general public is still inadequately informed about the benefits and risks associated with the development and applications of biotechnology. As a result, constraints such as low levels of public acceptance in certain countries and inadequate support by governments and the private sector continue to be encountered. Increasing public concern is anticipated to

arise in areas related to biotechnology impacts on the environment and on social ethics.

IV. TRANSFER OF ENVIRONMENTALLY SOUND TECHNOLOGY, COOPERATION AND CAPACITY BUILDING (CHAPTER 34)

A. Actions taken by CSD and related inter-sessional activities

25. CSD, at its first session, decided to establish an inter-sessional *ad hoc* open-ended working group to assist in the task of assessing and suggesting specific measures to support and promote access to and transfer of technology and in the development of the policy framework to facilitate, promote and finance technology transfer, particularly in relation to the sectoral clusters under consideration.

26. The Inter-sessional *Ad Hoc* Working Group on Technology Transfer and Cooperation, was held in New York in March 1994. The working group focused and made proposals to CSD on three key areas: (a) access to and dissemination of reliable information on environmentally sound technologies; (b) institutional development and capacity-building; and (c) financial partnership arrangements.

27. There were two other inter-sessional meetings of relevance to Chapter 34 prior to the second session of the CSD. One was the Workshop on the Transfer and Development of Environmentally Sound Technologies held in Oslo, Norway in October 1993, jointly organized by UNCTAD and the Government of Norway. The Oslo meeting recognized the need to formulate innovative approaches for technology transfer. The other meeting was a Preparatory meeting on Transfer of Environmentally Sound Technology Cooperation and Capacity Building held in Cartagena, Colombia in November 1993, jointly organized by the Governments of the United States of America and Colombia. The Cartagena meeting examined technology transfer issues in two sectors reviewed by 1994 session of the CSD: liquid waste management and energy efficiency.

28. CSD, at its second session in 1994, adopted the three key areas identified by the *Ad Hoc* Inter-sessional Working Group as priorities for the future work of CSD in relation to Chapter 34 of Agenda 21. At the same session, CSD stressed the following specific areas of activities, in particular: i) promotion of innovative technology transfer modalities and technology partnership arrangements at the enterprise level (including through foreign direct investment); ii) collecting information on venture capital funds for certain types of ESTs; iii) exploring the potential for joint ventures; iv) identification of gaps and/or deficiencies in the information sources or systems and proposals on feasible approaches; v) involvement of small and medium-sized enterprises; vi) sectoral and techno-economic studies and demonstration projects on the transfer of industrial ESTs and techniques; vii) examining the feasibility of establishing a consultative group on environmental technology centres; and viii) promotion of the contribution of national universities and research centres, particularly those of developed countries, in the transfer of available ESTs and expertise.

29. Following the Commission's second session, several intersessional activities were undertaken. The Workshop on the Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies was held in Seoul, Republic of Korea from 30 November to 2 December 1994. The Workshop concentrated on one of the priority issues identified by CSD at its

second session, and adopted the Seoul Plan of Action concerning information exchange about ESTs.

30. Another initiative was the Roundtable on Technology Transfer, Cooperation and Capacity Building, held in Vienna, Austria in February 1995 by UNIDO, in cooperation with UNEP and DPCSD. The purpose of the Roundtable Meeting was to explore the possibility of establishing joint action programmes and strategies for the building of capacities and promotion of ESTs in developing countries, especially with regard to the role of the industrial sector in contributing to the realization of the goals of Agenda 21. The Roundtable defined elements of a work programme on ESTs in three areas:

(a) Policy development

- the use of economic incentives in national policies;
- promotion of technologies for cleaner production and products;
- needs assessments

(b) Institutional development and capacity building: EST centres

(c) Partnership and cooperation

- south-south cooperation
- expanding global partnerships
- technology intermediaries

B. Improving access to and dissemination of information on environmentally sound technologies

31. The experiences gained in the development and operation of information systems and clearinghouses have shown that much work is required to collect and continuously update reliable and adequate information as well as to disseminate it to the end users. In the absence of a substantial amount of additional resources, the tendency is to build on available information systems and networks.

32. Constraints to accessing information on ESTs have included: high direct costs combined with lack of financing; barriers related to the proprietary nature of information systems or technologies; and lack of technical and managerial capacities; and the lack of knowledge on the potential contribution of ESTs to development objectives (resulting in lack of demand). A recognized problem is the weakness of vertical information flows between environmental/cleaner production agencies at one level and industries and non-industrial users at another. The horizontal information flow among different environmental agencies seems to be smoother.

33. The Cleaner Production Programme of UNEP IE has embarked on a strategy emphasizing information exchange to create awareness of the need for cleaner production and, thereby, increase the demand for the transfer of cleaner production technologies. The Cleaner Production Programme has no legally binding international agreement nor any special financial mechanism supporting either national programmes or technology implementation, which made it difficult to promote technology transfer within the framework of the Programme. The Cleaner Production Information Clearinghouse was thus developed under the Programme with the aim to become an effective information dissemination system providing relevant, timely and updated information.

34. The important role of small and medium enterprises (SMEs) in the transfer of ESTs, especially in developing countries, is increasingly

recognized. A study commissioned by UNIDO's Industrial and Technological Information Section (INTIB) concluded that there is a clear indication of a growing demand for environmental information in SMEs in the developing countries, at the same time, a shortage in information supply. The main factors contributing to this information shortfall would include the general tendency that information provided on advanced technologies are mostly targeted to the developed and not to the developing countries. Even in cases where information systems target users in developing countries, these are either large corporations, consultants or researchers at universities or research institutes which may have advanced communication capabilities. The use of advanced technologies and information systems for information transfer does not take into account the limited communication and data handling capabilities in the SME sector in developing countries, and therefore restricts their access.

35. The "Seoul Plan of Action concerning Information Exchange about ESTs" adopted at the Workshop on the Promotion of Access to and Dissemination of Information on ESTs suggested the establishment of a "consultative mechanism" to enhance cooperation and compatibility among existing and planned systems for the exchange of information related to ESTs, particularly those operated by - or with the support of - the United Nations system and under international conventions. A draft outline for the suggested consultative mechanism proposes implementation in two phases. Major actors in the first phase would be United Nations agencies and organizations, secretariats of the relevant international conventions, and other selected international organizations such as the OECD and the IEA. In the second phase, the mechanism may be extended to the participation of other actors, such as managers or private sector information systems related to ESTs as well as business and industry associations.

C. Capacity building for managing technological change

36. The traditional supply-oriented approaches to technical assistance have failed to produce expected results in capacity building. Given such a realization, there has been more emphasis on a participatory approach involving all the stakeholders (including end-users, entrepreneurs, researchers, extension service agents, planners and policy-makers at all levels), on reinforced support to the local private sector, on establishing and strengthening linkages of various kinds, and on inter-disciplinary approaches.

37. Lack of adequately trained manpower, including technology transfer managers, subject matter specialists, extension workers and farmers, has been a major bottleneck in effective transfer of improved technologies. The paucity is getting acute as the process of technology generation and transfer is becoming increasingly complex.

38. In promoting rural-based enterprises as the vehicle for the utilization of post production technologies and as a means of providing livelihood opportunities in the rural communities, manpower training is considered an important requirement to equip project managers and cooperation partners with the skills needed to make informed decisions on the transfer, use and dissemination of technologies that are conducive to sustainable development. It also became evident that training seminars and field demonstrations are important avenues to elucidate and persuade technology end-users of the benefits and risks involved in the application of certain technologies.

39. The CSD, at its second session in 1994, recognized that assessment of needs for capacity building and institutional development related to ESTs could be useful in enhancing development, deployment and transfer of those

technologies. In order to benefit from the experiences gained from those exercises in a broader context, the CSD encouraged developed and developing countries to jointly conduct case studies on needs assessment at the national level. Such case studies are being planned in a number of developing countries.

D. Promoting technology cooperation and partnerships

40. The rapid growth of the demand for ESTs, particularly in developing and the newly industrializing countries and countries with economies in transition, open up new opportunities for EST cooperation and partnerships. Expansion of global operations of major firms, as they set up foreign operations to enter markets, and seek foreign partners to develop new technologies, may also advance the scope for EST cooperation and partnership arrangements.

41. External evaluations of the scientific and technological cooperation programmes with developing countries and countries with economies in transition launched by the European Community, have highlighted a number of lessons for future cooperation in research and technological development:

(i) the importance of mutuality in the project planning and implementation phase;

(ii) the need to base scientific cooperation on the priority needs identified in developing countries and economies in transition. Also, that without local/national support, investments in human capital and scientific infrastructure are not sustainable;

(iii) a clear need to see research priorities in relation to other policy areas such as development cooperation with third countries;

(iv) greater input from local scientists in developing and Central and Eastern European countries was necessary from project formulation through to management; and

(v) the economic and environmental problems of sustainable development required an interdisciplinary approach. Building on local knowledge was vital to make research and its results relevant.

V. SCIENCE FOR SUSTAINABLE DEVELOPMENT (CHAPTER 35)

A. Strengthening the scientific basis for sustainable development

42. Many developing countries lack the necessary scientific manpower and infrastructure to: (i) collect, analyse, interpret and disseminate scientific data and information related to the broad areas of sustainable development as defined in Agenda 21; (ii) develop and apply science-based policies, resource management systems and technologies; (iii) generate new knowledge through science relevant for sustainable management and policy making, in particular through interdisciplinary research. The gap between industrialized and developing countries, in terms of existing capacities in these areas, is also widening.

43. A critical but often neglected link in making effective use of science for sustainable development concerns communication. Science can have an

impact only if it is communicated to various non-specialist user groups in a language and form which can be understood and used. At present there is a serious gap between the producers and users, including policy makers, of scientific information.

44. Since UNCED, two intergovernmental processes have been launched which are specifically dedicated to supporting science for sustainable development in developing countries and to sensitizing governmental decision-makers at the highest possible level in this regard. The first process involves setting up a Commission on Science and Technology for the South (COMSATS) initiated by the Prime Minister of Pakistan. It endorsed the aim of creating twenty centres of excellence in the South as the frontier areas of science related to sustainable development and established the Network of International Centres of Excellence in the South.

45. The second intergovernmental process is the Presidential Forum on the Management of Science and Technology for Development in Africa, initiated by a regional non-governmental scientific organization (Rand Forum). An agreement was reached on holding the periodic sessions of the Presidential Forum as a major endeavor to sensitize the African geo-political geo-economic leadership to the crucial role of science-led development.

B. Enhancing scientific understanding

46. The strategy followed so far in designing and implementing major international research and observation programmes has proved to be sound in principle and feasible in practice. This strategy is based on two principles:

1. The programmes are based upon collaboration between the relevant United Nations bodies and one or more international scientific NGOs. Scientific quality and objectivity as well as policy making relevance is ensured in this way.

2. Scientists from the participating countries participate in designing the international coordinating framework or research agenda, in interaction with a high-level international scientific steering committee. The programme framework developed this way is then integrated into their respective national research and observation activity.

47. Significant progress has been made during the first few years in integrating environmental science in major fields of science like agriculture and health, etc. An example is the integration of a sustainable agriculture component into agricultural research as well as within the work of the international research centres of the Consultative Group on International Agricultural Research (CGIAR), co-sponsored by the World Bank, FAO and UNDP.

48. The integration of natural sciences and socio-economic research has begun at national, regional and international levels. Yet progress appears to be slower than anticipated. A problem shared by both developing and industrialized countries in this regard, is that most current training programmes and institutional structures are sectoral and disciplinary and do not address the complex interactions between people, natural resources, technology, environment and development. In this connexion, it is particularly urgent to provide support for innovative interdisciplinary capacity building activities.

C. Improving long-term scientific assessment

49. The primary objective of this programme area is to provide assessments of the current status and trends in major developmental and environmental issues at the national, sub-regional, regional and global levels.

50. Many subject areas related to environment and development have already significantly be efited from international scientific cooperation. However, there are several emerging interdisciplinary subject areas which are not yet adequately addressed by specific scientific programmes at the international level. One such area identified is environmental economics.

51. Methods presently used to assess different environmental values, such as option and existence values, are not yet universally agreed upon. International scientific cooperation is needed to develop the methodologies which will take into account different cultural and socio-economic situations. The range of issues at the interface of environment and economics, and the scientific inputs necessary to address them, are too broad to be covered by any single institution.

D. Building up scientific capacity and capability

52. Little specific action has been taken at the national level since UNCED in building up scientific capacity for sustainable development

53. As stated in UNESCO's World Science Report for 1994, many industrialized countries spend about 3% of their GNP on R&D activities. In developing countries, the figure in most cases is significantly below 1%. This demonstrates that there is a great shortfall of funds needed for increased scientific capacity building in developing countries and in particular in the least developed countries.

54. Financial support to developing countries in the field of sciences is provided by a number of bilateral donors. However, the limited availability of funds for research assistance and training in specialized scientific fields has become a particular concern. With the overall volume of development assistance funds shrinking and with acute emergencies in developing countries increasing, it seems to become more and more difficult to defend aid budgets for long-term capacity-building for research.

55. Despite considerable efforts, many developing countries, and in particular LDCs, do not yet possess a critical mass of trained personnel in specialized fields and in interdisciplinary approaches related to sustainable development. There needs to be increased efforts to train specialists in many specific areas of science, including those in the sectoral chapters of Agenda 21 (i.e. Chapters 9 to 22). Lack of training facilities at universities or other institutions in many developing countries must also be overcome.

56. A critical but often neglected link in making effective use of science for sustainable development concerns communication. At present there is a serious gap between the "producers" of scientific information and the "users" of such information, including policy makers, teachers, the media, NGOs, and other groups which play a major role in taking action towards sustainable development. The information on which decisions and actions are based is sometimes too sectoral or narrowly-focused to be relevant to the actual needs.

VI. POSSIBLE CONTRIBUTION OF CSTD IN THE FUTURE

57. The contribution of CSTD to CSD's deliberation at its third session in 1995 through CSTD'S Panel on Science and Technology for Integrated Land Management, was much appreciated by CSD, as the Panel provided additional and complementary dimensions to the review of land management, Chapter 10 of Agenda 21.

58. There are other sectoral chapters where science and technology inputs would be very helpful both in analysis of the progress being made/problems encountered and in furthering the efforts to advance implementation and to overcome obstacles. CSTD may wish to consider additional topics where it could provide the complementarity, or focus on those dimensions of chapters 16, 34 and 35 that have not yet been covered.

Annex I

LIST OF MEETINGS RELEVANT TO CHAPTER 34 "TRANSFER OF ESTS, COOPERATION AND CAPACITY-BUILDING"

1. Meeting on "Transfer of ESTs, Cooperation and Capacity-Building", with focus on energy efficiency and liquid waste management, jointly organized by Colombia and the USA, Cartagena, Colombia, 17-19 November 1993.

2. Workshop on "The Transfer and Development of ESTs", jointly organized between Norway and UNCTAD, Oslo, Norway, 13-15 October 1994.

3. Inter-sessional Ad Hoc Open-Ended Working Group on Technology Transfer and Cooperation, New York, February 1994.

4. Third High-Level Advisory Seminar on Cleaner Production, Warsaw, Poland 11-14 October 1994.

5. OECD Workshop on Development Assistance and Technology Cooperation for Cleaner Industrial Production in Developing Countries, Hanover, Germany 28-30 September 1994.

6. Workshop on The Promotion of Access to and Dissemination of Information on ESTs, hosted by the Government of the Republic of Korea, Seoul, 30 November-2 December 1994.

7. Round Table on EST Transfer, Cooperation and Capacity-Building, organized by UNIDO, in cooperation with UNEP and DPCSD, Vienna, Austria, 6-8 February 1995.

Annex II

AGENDA 21 CHAPTERS HAVING STRONG COMPONENTS OF SCIENCE AND TECHNOLOGY

Sectoral themes

Chapter 6	Protecting and promoting human health
Chapter 7	Promoting sustainable human settlement development
Chapter 9	Protection of the atmosphere
Chapter 10	Integrated approach to the planning and management of land resources
Chapter 11	Combatting deforestation
Chapter 12	Managing fragile ecosystems: combatting desertification and drought
Chapter 13	Managing fragile ecosystems: sustainable mountain development
Chapter 14	Promoting sustainable agriculture and rural development
Chapter 15	Conservation of biological diversity
Chapter 16	Environmentally sound management of biotechnology
Chapter 17	Protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use and development of their living resources
Chapter 18	Protection of the quality and supply of fresh water resources: Application of integrated approaches to the development, management and use of water resources
Chapter 19	Environmentally sound management of toxic chemicals, including prevention of illegal international traffic in toxic and dangerous products
Chapter 20	Environmentally sound management of hazardous wastes, including prevention of illegal international traffic in hazardous wastes
Chapter 21	Environmentally sound management of solid wastes and sewage-related issues
Chapter 22	Safe and environmentally sound management of radioactive wastes

Cross-sectoral themes

Chapter 34	Transfer of environmentally sound technology, cooperation and capacity building
Chapter 35	Science for sustainable development

REFERENCES

1. Report of the Inter-sessional Ad Hoc Open-ended Working Group on Technology Transfer and Cooperation (E/CN.17/1994/11).

2. Report of the Secretary-General on cross-sectoral issues (E/CN.17/1994/2).

3. Report of the Secretary-General on progress achieved in facilitating and promoting the transfer of environmentally sound technology, cooperation and capacity-building (E/CN.17/1993/10).

4. Report of the Secretary-General on Science for Sustainable Development (E/CN.17/1995/).

5. Report of the Secretary-General on the Transfer of Environmentally Sound Technology, Cooperation and Capacity-Building (E/CN.17/1995/).

6. Report of the Workshop on the Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies (ESTs).

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TECHNOLOGICAL ASPECTS OF: (b) Conversion of military capacity

Scientific and Technological Aspects of the Conversion of Military Capacities for Civilian Use and Sustainable Development

An Overview of main issues

Report by the UNCTAD secretariat

GE.95-50693

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Executive summary

(i) Military production and expenditures continue to be a source of deep concern in a world in which the majority of countries face severe economic, social and financial problems reinforced by an increasing environmental degradation.

(ii) The end of the cold war and the evident decline of military threats between major powers of the world have raised hopes that political leaders will seize an historic opportunity to focus their attention on productive human endeavours which might be financed from redirecting some of the resources allocated to the military or could accrue from peaceful application of a vast scientific and technological reservoir formerly at the exclusive disposal of the military.

(iii) This situation underscores the need for conversion of military production and technologies as an effective strategy to accompany national and international disarmament efforts, and as a contribution to a development path in harmony with the natural carrying capacity of our planet.

(iv) The new paradigm of sustainable development has broadened the traditional understanding of security: threats to nations or to the world community are no longer limited to military aggression. Global environmental change and the destabilizing effects of the persistent poverty of large segments of the world population are equally perceived as vital risks to nations.

(v) The notion to diversify resources traditionally spent on the military and released in the process of disarmament to address such risks is intriguing. Scientific and technological aspects, including the conversion of military research and development (R&D) with the objective to develop environmentally sound technologies, or to find ways for halting environmental degradation in parts of the developing world, are of particular interest in this context. However, the existing potential of resources, skills and technologies is currently not used.

(vi) The report begins with an introduction of the concept of conversion and recalls United Nations activities related to its scientific and technological aspects. It continues by describing the role of science, technology and R&D in the conversion process. Furthermore, it illustrates how military R&D and technologies could be used for environmental protection in the pursuit of sustainable development. Finally, the report concludes with references to several issues of concern to the international community and to potential priority areas for further consideration in the above context.

Preamble

1. This study has been prepared pursuant to the Economic and Social Council Resolution 1993/70 which requested that a report be submitted to the Commission on Science and Technology for Development at its second session on scientific and technological aspects of the conversion of military capacity for civilian use and sustainable development.1/ The report was to draw on recent and ongoing activities in this field including the international conferences organized by, or in cooperation with, the United Nations Secretariat on scientific and technological issues of conversion. Particular reference was also made to the activities of UNCTAD and of the Ad Hoc Working Group on the Interrelationship between Investment and Technology Transfer (E/CN.16/1995.10).

2. Independently, the Trade and Development Board of UNCTAD, by decision 420 (XLI) of 30 September 1994 adopting the terms of reference for the Ad Hoc Working Group to Explore the Issue of Structural Adjustment for the Transition to Disarmament,2/ has referred to the relaxation of international tensions which provides incentives and opportunities for countries to reduce military spending and to divert such resources towards socially productive uses. The work of the Ad Hoc Working Group was to be coordinated with that of other committees of the United Nations. Accordingly, the findings of this report will also be made available to the working group.

3. The UNCTAD secretariat acknowledges the voluntary cooperation and the substantive inputs received from the Institute for Environmental Protection (INFU) of the University of Dortmund, Germany, in the preparation of this report.

Introduction

4. Throughout history there has always been some reduction in military production in times of détente following wars. However, the end of the Cold War, in the aftermath of one of the biggest military build-ups and arms races ever, has left in its wake problems of unexpected magnitude. For the first time, the need to transform large-scale scientific, technological and industrial capacities designed to serve the military-industrial complex has become a worldwide phenomenon affecting all major powers as well as many smaller countries. At the same time, the challenges of global environmental change as well as persistent poverty, particularly acute in developing countries, have led the world community to adopt - at the United Nations Conference on Environment and Development -a new paradigm of sustainable development. The question of how to redirect some of the resources formerly devoted to the arms race towards environmental protection and accelerating the development process has increasingly become part of this discussion. Such a "trade-off" has been termed the "peace dividend". It became evident, however, that the process of conversion is complex and that it encompasses a broad range of issues of concern to the international community. These include:

- **A new understanding of "security"**: Threats to nations are not simply just military threats. Today, the future of nations is equally threatened by global environmental change and economic or social instability;

- **Industrial restructuring for sustainable development**: Conversion of the military-industrial complex into clean, market- and consumer-oriented production facilities is part of overall efforts of industrial restructuring in the pursuit of sustainable development;

- **Human Resources Issues**: In countries where the military sector (industry, national R&D institutions, and the armed forces themselves) is particularly important as compared to overall economic activity, unemployment - including that of scientific and technological staff - resulting from disarmament, could lead to an outflow of skills to nations still expanding military R&D and production;

- **Cleaning of abandoned military sites**: These are often among the worst areas struck by toxic waste pollution. This is a task which requires scientific and technological inputs. Closely related to this aspect of conversion is the environmentally sound disposal of existing military hardware;

- **Developing timely alternative use plans for military sites and facilities**: This is part of the development strategy in communities heavily dependent on the presence of such facilities. It is essential to avoid large-scale unemployment and to secure public support for conversion measures. It requires, *inter alia*, technology assessment and economic projection.

5. Different terms are being used to describe the process of conversion. For example, the Department of Defense in the United States of America prefers the term "reinvestment", thus focusing on "the investment activities of the

Department of Defense that can lead to new opportunities in the economy and for business."3/ This includes "investment in people" who formerly served in the armed forces or worked for the defence industry by providing job-training programmes and information services for career changes, investment in technology as well as reinvestment of capital assets (such as closed bases, unneeded technical laboratories etc.).4/ Similarly, UNCTAD's Trade and Development Board has used the term "structural adjustment for the transition to disarmament", emphasizing the restructuring of economies. Throughout this report, the term "conversion" is being used to represent a broad array of measures which are economic, political, scientific and technological. Furthermore, the term "restructuring" is introduced where applicable.

6. The growing body of knowledge from actual conversion experiences (both successful and failed ones) in different parts of the world has been accompanied by a broad discussion of strategies to utilize the expected peace dividend for sustainable development efforts. Such a pay-off cannot simply be described in financial terms. While the release of actual financial resources from military to civilian budgets is questionable, the peace-dividend essentially exists in terms of human resources as disarmament is freeing scientific and technical personnel to pursue profitable civilian R&D, and in terms of a long-term economic impact resulting from the restructuring of production from a narrowly-based military one to a more efficient production serving a broader civilian market. It is in this context that a conversion policy to manage effectively the disarmament process is of utmost importance.

I. United Nations activities

7. Before entering into the general discussion, a brief account of United Nations activities related to scientific and technological issues of conversion is provided to serve as an overview of past activities.

8. The United Nations has long served as a forum to discuss military conversion activities. A study undertaken by the United Nations Institute for Disarmament Research (UNIDIR) recalls that successive United States and [former] USSR draft proposals in 1962 for a "Treaty on General and Complete Disarmament (GCD) provided for control and conversion of military R&D for peaceful civilian purposes."5/ The United States' "Outline for basic provisions on a treaty on GCD in a peaceful world" of 18 April 1962 called for the establishment of an international disarmament organization within the framework of the United Nations. Such an organization would collect reports from the "Parties to the Treaty" on any basic scientific discovery and any technical invention having potential military significance and - on the recommendation of expert study groups -work out agreed arrangements for verification by the organization that "such discoveries and inventions were not utilized for military purposes". Furthermore, "the Parties to the Treaty would agree to support full international cooperation in all fields of scientific research and development and to engage in full exchange of scientific and technical information and free interchange of views among scientific and technical personnel".6/

9. In spite of such early efforts, conversion did not become politically feasible until the late 1980s when a new détente in international relations changed such ideas from an utopian concept into a very practical problem to be

solved in many parts of the world. Again, the United Nations served as a forum for such discussions on conversion. Thus, in 1988, the United Nations University (UNU) was co-sponsor with Meiji Gakuin University of a conference on *Science and Technology for Peace: Towards Conversion of R&D from Military to Civil Use*, in Yokohama, Japan. This conference brought together peace researchers from several countries to discuss the new opportunities arising from a changing political climate in the world and possible shifts in the established system of alliances. Yet, the resulting prospects for converting military into civilian R&D were still more a theoretical than a practical matter.

10. In September 1989, the former United Nations Centre for Science and Technology for Development (UNCSTD) convened a panel of eminent persons in New York to reflect on a number of issues of global significance including "Disarmament and economic conversion". Starting with an account of the immense armament expenditures world-wide at the time, the experts called for a conscious conversion of military resources towards economic development.7/ Subsequent events underlined the relevance and the timeliness of this subject. Moreover, these events transformed the issue of conversion from the subject of an academic discussion into a compelling economic need in many countries.

11. In the 1990s, the linking of conversion to the struggle for sustainable development became an issue increasingly addressed at the United Nations. Thus, in 1991, the Secretary-General of the United Nations provided the General Assembly with a report on the issue of "General and complete disarmament", entitled "Charting potential uses of resources allocated to military activities for civilian endeavours to protect the environment."8/ The study proposed, *inter alia*, to utilize technological capabilities of military establishments including their R&D endeavours, laboratories, equipment and expertise for measures designed to protect the environment. It identified such opportunities, particularly with respect to dual-use technologies, areas such as environmental monitoring, environmental emergency management, impact assessment, and specific actions to protect the environment (for example, improved energy production and utilization, environmental clean-up, waste treatment and remediation strategies). Reflecting such discussions over the previous years, the Secretary-General's 1994 "Agenda for Development" called for world hearings on the connection between disarmament and development.9/

12. In addition, between 1991 and 1993, four major United Nations conferences were organized to address particularly scientific and technological issues of military conversion: The first of these, the *Conference on International Cooperation in Peaceful Uses of Military Industrial Technology* (Beijing, China, October 1991), was jointly organized by UNCSTD and the China Association for Peaceful Use of Military Industrial Technologies. It suggested that international cooperation include arms-related trade arrangements and regulations, and the transformation of existing bilateral programmes of military assistance into bilateral development programmes specifically designed to facilitate the transition to disarmament. Participants proposed that the United Nations assist in facilitating the transfer of know-how or cooperation between nations in diverse areas such as the destruction of chemical weapons, peaceful uses of outer space and the aerospace complex.10/

13. The international conference on *Conversion - Opportunities for Development and Environment* (Dortmund, Germany, February 1992) was jointly organized by UNCSTD and the Institute for Environmental Protection (INFU) of the University

of Dortmund, under the sponsorship of the State Government of North Rhine-Westphalia. It considered a broad set of issues related to military conversion ranging from sustainable development aspects to East-West and North-South cooperation. The conference explored, in particular, opportunities for development and environmental protection with special emphasis on the role of science and technology. These discussions resulted in the Dortmund Declaration, a portfolio of specific recommendations to the international community and national governments (see Box 1).11/

Box 1

Excerpts from the Dortmund Declaration

- Disarmament is an essential pre-condition to respond to increasing economic, social and financial needs and to reverse trends of environmental degradation at local, national and international levels. However, to implement disarmament efforts and to reduce the international proliferation of arms, it is indispensable to introduce policies and programmes of conversion of military production and technology for its civil use, preferably under the governance of the United Nations;

- Policies of military conversion should address environmental issues. Specific conversion activities should be based on technology assessment exercises, taking into account environmental concerns;

- The transformation of military-related research and science and technology activities has to be addressed as a central area of conversion policy;

- Scientific institutions should be supported worldwide in their efforts to give special attention to research on economic, technological, sociological, organizational and environmental aspects of conversion and to seek new forms of international research partnerships, in particular, in co-operating with institutions in developing countries and countries with economies in transition.

(Source: Conference report "Conversion- Opportunities for Environment and Development").

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14. The United Nations Conference on the *Conversion of the Aerospace Complex* (Moscow, Russia, October 1992) was organized by the former United Nations Department of Economic and Social Development (DESD) in cooperation with the Government of the Russian Federation. It analyzed the aerospace complex as a particularly promising area with regard to the conversion of scientific and technological capacities. Among its recommendations to the international community, policy-makers and the private sector was a proposal to establish national and regional conversion centres. Linked through data bases, these centres would provide institutional support to Member States and training for managers of military enterprises. One major follow-up activity of the Moscow Conference was the establishment of the Russian Centre for Conversion of the Aerospace Complex12/ (see Box 2).

Box 2:

Russian Centre for Aerospace Conversion

The Russian Centre of Aerospace Complex Conversion was created in accordance with a decree of the President of the Russian Federation. The Centre started its operational work in January 1993. It aims at promoting the conversion of the scientific, technical, industrial and personnel potential in the existing aerospace complex; at increasing the economic, social and ecological potential of cooperation in this field; promoting the conversion of military enterprises and their integration into the world economy; creating the necessary material and technical conditions, and providing legal support, coordination and information in order to carry out national and international programmes and projects. Among the members of the Centre are large corporations of the Russian aerospace complex as well as other branches of industries, leading design bureaux, scientific centres, banks and other commercial and public institutions. The Centre establishes mutually beneficial relations with Russian enterprises and organizations, foreign investors and partners, and supports the creation of financial and industrial companies, production and economic associations, banks and all other necessary structures. It creates also branches and representations in Russia and abroad. The Centre elaborates and monitors regional and international programmes and projects. It cooperates with international organizations such as the United Nations Secretariat, UNIDO, UNDP, national and regional aerospace agencies as well as different foreign partners. The main fields of cooperation are in advanced material technologies in aviation, cosmic, radio - electronic, communication and other industries.

(Source: Russian Centre of Aerospace Complex Conversion).

15. The conference on *International Cooperation to promote Conversion from Military to Civilian Industry"* (Hong Kong, July 1993) was jointly organized by the United Nations Department for Development Support and Management Services (DDSMS) and the China Association for Peaceful Use of Military and Industrial Technology. The *Hong Kong Declaration on Conversion from Military to Civilian Industry* emphasized, in particular, the need for international cooperation, new funding strategies, training and information. It highlighted the importance of creating enabling environments for military enterprises to carry out conversion. In this context, it also stressed the particular need to focus on human capital in the military industry as an invaluable source in the conversion process.13/

16. In addition to the above, a number of United Nations bodies have addressed issues of conversion within their specific mandates. These included, *inter alia*, the Global Technology Group of the United Nations Development Programme (UNDP),14/ the International Labour Office (ILO)15/, the United Nations Economic Commission for Europe (ECE),16/ the United Nations Environment Programme (UNEP),17/ the United Nations Institute for Disarmament Research (UNIDIR)18/ the United Nations Industrial Development Organization (UNIDO),19/ and the United Nations University (UNU).20/

II. Scientific and technological aspects

A. The role of science and technology and the military

17. In today's economies, science and technology are dynamic forces and important factors in the prospects for development, growth and social welfare in developed and developing countries alike. Science and technology can be both highly creative forces, driving economic productivity and contributing to a broad range of societal goals, such as improved food production, public health and human development, as well as destructive ones causing pollution, environmental degradation and the development of lethal weapon systems. A UNIDIR study concluded: "In fact, the employment of science and technology for military purposes and the accumulation of weapons of mass destruction amounts to a perversion of science. It contradicts the basic calling of science and technology - which is the betterment of the human condition."21/

18. The relationship between the scientific community and the military intensified in the years following the Second World War, a period in which the military apparatus has "been grounded increasingly on the application of advanced scientific knowledge to weapons of mass destruction." 22/ Indeed, many countries regarded military research and development as an important element of national security.

19. According to a study conducted in the late 1970s, 24 per cent of the global R&D efforts were military driven compared with, for example, 8 per cent allocated to space, 8 per cent to energy, 7 per cent to health, 5 per cent to transportation, and 3 per cent to agriculture and food production.23/ The 1994 *Human Development Report* estimated the number of people engaged in military R&D at 1.5 million (out of 5-7 million of total R&D personnel worldwide).24/ Thus, military R&D could be considered a major employer of scientific and technical personnel. In many countries, military R&D even reached a dominant position

within the national R&D infrastructure, at least temporarily. Altogether, since World War II, hundreds of billions of dollars have been spent on military R&D.25/ Since, in most cases, the actual spin-offs of military technology have been few and as the secrecy surrounding military R&D has prevented timely reflection of a systematic utilization of its results in civilian applications, R&D funding of key civilian technologies which could contribute to development have been severely constrained. The reduction of military expenditure should thus be expected to liberate significant scientific and technological potential for civilian use.

20. In the above context, a working paper submitted by Colombia to the United Nations Disarmament Commission referred to the enormous technological inputs still required for the process of development and the continuing asymmetry which exists between the technological capacities of the developed and the developing countries.26/ The paper concluded that, in light of such discrepancies, military research reflected a wastage of manpower, skills, talent and economic resources which, in the long run, could contribute little to the economic development of nations.

B. Conversion of R&D resources

21. Military R&D has been a central element of the arms race. Yet, the restructuring of public and private military R&D sectors and their possible conversion to civilian purposes is not an easy endeavour and the scope for action may be limited. The myth that military R&D intrinsically contains large spin-offs of considerable economic utility only holds true for a limited number of technologies, known as dual-use technologies in areas such as computer sciences, avionics, semi-conductor devices and electronics. According to UNIDIR, in some areas the opposite interaction has taken place, i.e. civilian technologies have had military "spin-ons", rather than military R&D benefiting civilian production in the long-run.27/ Similarly, the Office of Technology Assessment of the United States Congress has found that "increasingly, leading - edge technology is developed in the civilian sector and then finds its way into defense applications."28/

22. In view of the above, a diversified conversion strategy is required relying on identifying specific technologies, developing clear targets and setting priorities. A study prepared for the United Nations University (UNU) came to the conclusion that there are basically four options for military R&D facilities, each with different consequences: (a) continued funding with the aim of gradually diversifying into non-military R&D. The concern, however, would be that these facilities could again revert to military work; (b) giving military R&D facilities entirely civilian tasks (complete conversion); (c) disbanding the facilities irrespective of the employment and other economic effects involved; and, (d) mothballing facilities and maintaining skeleton staffs that continue to have as their primary mission the development of new weapons.29/

23. The establishment of an effective strategy in response to the above choices involves several stages. As a first step, levels of public and private R&D expenditures on military as compared to civil use could be documented and the benefits analyzed. As a further step, diffusion of knowledge from military to civilian entities in R&D as well as production could be encouraged through

appropriate incentive schemes and legislation. In this context, operational programmes dealing with a changing role for R&D institutions need to be developed in accordance with the overall restructuring of military hardware usage, military facilities, personnel training, etc., as well as action related to environmental recovery.

24. A number of initiatives for R&D conversion which have been taken in various countries illustrates the range of opportunities. The Government of the United States, together with the "Big Three" automobile giants, General Motors, Ford and Chrysler, announced in October 1993 a common research project to develop a "vehicle for tomorrow". The project aims in particular at reducing the fuel consumption of automobiles to one-third of today's consumption over the next ten years. The United States Government intends to involve mainly scientists and research laboratories formerly occupied by military and defence-related research activities. The project should determine how new advanced materials, originally developed for military applications, could be used in car manufacturing. It should focus on the use of new electrical engines which were developed under the Strategic Defence Initiative (SDI) in cars and should give emphasis to three main areas: first, new production technologies to expedite the development of automatic systems; second, the improved efficiency of automobiles in terms of lower environmental pollution, and, third, the development of new prototypes that consume only 30 per cent of current fuel use. The cost of the project will be shared between the United States Government and the automobile industry. While the Government will not grant direct financial means for the project, it will provide research capacities of governmental laboratories that would otherwise close because of a reduction in the defence budget. The project was compared with the "Man to the Moon" programme under the Kennedy Administration, because it is expected to identify and produce spin-off technologies for other sectors.30/

25. Likewise, in the United States, a political initiative was proposed by the former Governor of the State of New York, Mario Cuomo, to connect the state capital, Albany, with New York City by a magnetic-levitation high speed train system. This proposal was made in November 1993 with the specific purpose of involving the New York defence industry in the project. Mag-lev-trains are perceived as an environmentally safe and future-oriented means of transport that allows especially highly sophisticated defence industries to open up a new civilian global market.31/

26. A Russian space technology company, "Sojuz", has developed a technology which made it possible to produce diamonds from explosives used in shells and ammunition. The technology became the basis for a joint venture with a German company and became particularly important for the decommissioning and denaturalization of military ammunition such as shells. Up to then, explosive substances had to be incinerated, causing severe environmental problems at very high costs. With the newly produced diamonds, it was possible to find a profitable way to recycle harmful chemical substances.32/

27. The above examples give evidence of the diverse opportunities for restructuring military R&D into economically and environmentally useful production. Over the past decade, there have been many more experiences, particularly in the Russian Federation and in the People's Republic of China. According to the Russian experience, enterprises oriented to production in fields of medium-level technology were often able to find new customers on

domestic markets, while high-tech R&D facilities which had never been incorporated into the overall structure of industry encountered substantial difficulties.33/

28. Since conversion is an integral part of overall industrial restructuring of economies, as referred to above, the incentive schemes that have been established to enhance the diffusion of science and technology more generally, could also be used as a framework for the conversion of military R&D and technology into civilian applications. These are described in detail in other documents made available to the Commission.34/ Such schemes have to pay attention to intellectual property rights which not only have important functions in the protection of technologies emanating from the military R&D activities, but also in licensing specific military technology for civilian use. The experience available to date has shown that intellectual property rights could be an important factor in the process of conversion. This role would need to be further examined in terms of different categories such as patents, utility models and copyrights.

29. At the international level, a number of options are available to redirect or transfer military R&D to civilian purposes. For example, technologies developed for decommissioning and demobilization of military hardware and ammunition could be made widely accessible at concessionary terms to interested countries through an international technology transfer mechanism whose feasibility needs to be explored. Furthermore, the data obtained by global monitoring satellites currently used exclusively for military purposes could be utilized for civilian R&D, especially for sharing global data among countries for resource development.

30. Initiatives for conversion of R&D resources are not limited to governments. The role of universities and scientific research centres is important in this context. Thus, bearing such responsibility in mind, the senate of the University of Dortmund (Germany) adopted the commitment "to conduct exclusively research activities that serve only civilian purposes and, furthermore, to ensure that in the future no R&D projects will be conducted which should serve discernibly military purposes". This self-commitment holds true as well for research projects carried out on a contract-basis.35/ Similar initiatives were taken by universities in the United States in the 1970s and 1980s.36/

C. Converting military into environmental technologies

31. One area where a conversion strategy is particularly useful concerns efforts to achieve sustainable development. Of all military capacities, "technologies qualify most for environmental use",37/ especially those which are inherently dual-use. Major areas in this regard include information technologies, materials, aerospace, space and energy. In this context, the reallocation of skills and capabilities from military to environmental tasks is needed, particularly in areas such as environmental monitoring, chemical analysis, cartography, medicine, microbiology and radiology. The transfer of such scientific and technological capacities at the disposal of the military to environmental applications encompasses several dimensions, particularly, (a) the need to redesign technologies to be suited to new applications; (b) the physical

transfer to locations where the technologies are needed (including other countries); and (c) cooperation between the government-directed military and the private sector in the commercialization of technologies.

32. The opportunities for conversion are seen both from the point of view of better and more efficient use of scientific and technological capacities of the military for the development of environmentally sound technologies, on the one hand, and repairing the current environmental damage, including that caused by previous military activities on the other hand.

33. Modern military establishments "have developed highly sophisticated techniques and technologies such as sensors, platforms, satellites, computers, communication networks, global positioning systems, and exercises for simulation and modelling".38/ In some instances, environmental applications have either already been undertaken or are under way. In others, the underlying technology can be adapted. Information technology, in particular, seems to be adaptable for environmental purposes. Resources currently used by the military could be applied to protect, restore and improve the environment; military establishments can assist in achieving these objectives by contributing their technical expertise, advanced equipment and communications and surveillance systems. The range of scientific and technological areas which could be used for such purposes include: (a) the industrial and technological capacity within the areas of transportation, communication, energy and engineering, including the development of ecologically benign and energy efficient technologies; (b) linkages between existing networks of the military sector, universities and other institutions for the dissemination of information and data, including measures for raising environmental consciousness; (c) satellite technologies for remote-sensing, global monitoring and telecommunication; (d) technical capacity in laboratories and computer facilities to detect and combat environmental degradation; (e) military manpower and equipment for disaster relief, including responses to environmental catastrophes, and handling or disposal of highly toxic, radioactive and other harmful substances as well as the destruction of weapons.39/

34. The defence community has at its disposal a wealth of information gathered by intelligence sources that can assist in tracking changes in the atmosphere, the oceans and the surface of the earth. Military satellites, aircraft, surface ships and submarines have the ability to collect additional information about climatic changes and the flow and temperatures of oceans (see Box 3). In this context, techniques for military surveillance could be employed for monitoring transportation of pollutants and toxic materials, and for ensuring compliance with ecologically safe methods of weapons disposal.

Box 3:

"Military data for research on the environment"

Since November 1992 all available data of the "Integrated undersea sound surveillance system" of the US-Marine are being used for a project called "Whales 93". This civilian research project uses hydrophones that have been developed and deployed originally by the US-Marine to monitor and survey [former] Soviet submarines on their missions in the world oceans. Already, within the first three months, it was possible to register 35000 sounds and data derived from undersea earthquakes, volcanoes and whales. Whales generate for their navigation and search for food, sounds on low-frequency waves that can be heard over long distances and that can be distinguished through the use of hydrophones. One of these sea-mammals was tracked continuously for 43 days. The scientists involved in the project are seeking to find out the trails of the whales through the oceans and regional differences in their singing. The hydrophone system reaches almost completely across the Atlantic and Pacific Oceans. Scientists can use this military monitoring system, but are not allowed to make public the exact locations of the hydrophones and their performance capacity.

(Source: Frankfurter Allgemeine Zeitung, 1 September 1993).

D. Cleaning-up the Cold War legacy

35. Military activities have caused such formidable damage to the environment and to human health that their consequences will be felt for decades and, in instances of forms of radioactive contamination, for much longer. Unfortunately, hardly any of the world's nations are devoid of contaminated military sites, devastated landscapes, polluted groundwater and injured biota; furthermore, damage has been spread throughout the oceans and atmosphere. In those developing countries which have emerged from long periods of war or other conflicts, land-mines contaminate fields and roads.

36. The catastrophic nature of environmental contamination becomes more apparent as additional sites of contamination are discovered and as the effects of the damage at known sites manifests itself fully. The seepage of chemical or radioactive contamination into water systems and the corrosion of containers dumped at sea, containing chemical weapons or radioactive material are but two examples of problems that grow more serious with the passage of time. This will be discussed below (see also Box 4).

Box 4

A new horizon for Subic Bay

"The U.S. Naval facility at Subic Bay in the Philippines was one of the world's largest overseas military bases. Its transformation illustrates some of the major problems and opportunities of converting bases from military to civilian use.

(....)

By the time the base closed in 1992, the mayor of Olongapo had helped establish a Subic Bay Metropolitan Authority whose aim was to turn the former base into the "Hong Kong" of the Philippines. At the end of 1993, the authority had attracted 33 investors and US$ 340 million to the base including a US power corporation now running the power plant, a US petroleum company using the fuel tanks for distribution, Philippine garment manufacturers and international investors interested in creating resort facilities.

But the unknown level of environmental contamination - probably the most significant obstacle to further progress - is already deterring some international investors and could pose serious health problems in the future."

(Source: UNDP - Human Development Report 1994)

37. The scope of the problem and the technological needs can only be hinted at. Thus, pollution from radioactive waste stored on land and at sea is a subject of great concern. In some regions, nuclear waste has been stored in disregard of internationally accepted standards established to prevent environmental damage. Locating and assessing such sites is particularly urgent. In the first place, efforts must focus on pollution from radioactive materials, primarily those affecting oceans and waterways and, secondly, on chemical pollution resulting from the dumping of chemical weapons. In this context, problems of radioactive contamination arising from the accidental loss and decommissioning of nuclear submarines have received considerable public attention in the recent past. It is necessary to assess the effects on the marine and human environment of present levels of radioactivity, including the risks of increased levels of contamination owing to corrosion.

38. Similar problems exist regarding the storage and dumping of chemical weapons. The first step needed is to assess the contamination status and to identify the different chemical agents that are involved. The next step would be a risk analysis that takes into consideration the evaluation of corrosion, leakage and dispersion processes and the possibility of local migration and bio-accumulation. Priorities must be established and accurate estimates must be made of the remediation costs.

39. Another most pressing issue involves the introduction of remedial technologies for the treatment of contaminated land and groundwater. Such remedial technologies have to encompass biological, chemical, physical and thermal waste treatment technologies. The conversion and disposal of explosives and propellants are important tasks for future activities in this area. However, the applicability of recycling technologies as well as chemical disposal technologies for conversion purposes is still limited. Further investigations are currently underway in order to develop new processes and to improve the product quality. For example, experimental studies have demonstrated the biotechnological degradability of a series of explosives. Microbiological treatments make use of natural purification effects working with water streams under high pressure and using chemical additives. Such new technologies open up completely new horizons to the elimination of dangerous materials (see also Box 5).

Box 5

"**Chemical weapons technology to combat natural disasters**".

One of the most secret military research institutions of the Russian Armed Forces was recently partly opened to the public to allow civilian research activities. Under the overall guidance of the Ministry of Defence of the Russian Federation, a new Department of Ecology and Special Means of Defence was established that uses mainly research capacities which were formerly devoted to the development of chemical weapons. It is selling new civilian technologies on the international market. One missile technology was, for instance, transformed to fight huge industrial fires such as those at oil wells during the Gulf War. This technology uses special missiles to combat fires from a distance without endangering the firefighters. Another technology was developed to fight against desertification in the Aral Sea. This technology uses a liquid polymer that can be sprayed over large-scale regions. After a short while, it binds the soil and sand and allows the flora to resettle in this region. This technology can be of particular use to combat desertification in semi-arid areas of the world.

(Source: Presentation by Gen. Sergei I. Grigorov at the International Workshop on Remediation of Contaminated Military Sites, Berlin, September 1993).

40. The effort needed to correct these problems is truly massive. A comprehensive and fast solution is beyond the economic means of today's societies. Even spread over generations, satisfactory clean-up can only be managed by prioritizing the problems, tackling or containing those that are the most urgent and developing more cost-effective technologies. International efforts are imperative, not only because of the magnitude of the problem, but

also because of their transboundary character. This requires a coordinated effort relying heavily on existing institutions, including military ones, to share experiences and resources. Such cooperation would be a first vital step towards eliminating the most noxious and long-lasting consequences of the Cold War. Some such initiatives are already under way. Thus, for example, work plans as well as pilot studies proposed by the Science Committee of the North Atlantic Treaty Organization (NATO) and its Committee on the Challenges of Modern Society (CCMS), have started to enable cross-national cooperation and consultation in political, military, economic, scientific and environmental domains and have greatly intensified NATO's involvement in environmentally-related issues.40/ Those initiatives have involved non-NATO Member States such as the economies in transition.

III. Conversion and sustainable development: Conclusions and recommendations

41. Serious efforts are necessary around the world to carry out and to promote the conversion process by specifically addressing the imperatives of socioeconomic development and environmental protection. The emergence of a high-level political will is a precondition for a successful conversion process and the materialization of a "peace dividend", even though existing economic imperatives and environmental forces could hasten this process.

42. Conversion could be viewed as a simultaneous and integral part of arms reduction efforts. In this context, its employment creation potential has to be weighed against the anxiety of potential unemployment owing to arms reduction and spending cuts in defence budgets. Similarly, the long-term export potential for civilian goods and services created by conversion should be balanced against the economic returns of the arms trade. There is no shortage of alternative uses of science and technology in areas such as alleviation of poverty, increasing demands for health, education and housing and pressing needs to protect and improve the environment.41/

43. Conversion is an exercise where tremendous short-term costs have to be balanced against long-term benefits and opportunities. Cleaning up the Cold War legacy and restructuring industry are complex and costly ventures. At the same time, science and technology have become ever more important elements of countries' international competitiveness, and funds spent on military R&D - and therefore not available to civilian R&D today - may have long-term adverse economic effects.42/ Thus, the restructuring of military R&D establishments should be viewed as an investment process that allows more funds to be channelled into key technological areas rather than into the development of weapons.

44. Conditions for conversion differ between industrialized countries, developing countries and economies in transition. In each context, it is necessary to identify a portfolio of basic human and ecological needs to which conversion measures could be directed and to identify the scientific and technological resources that can meet such demands. The issues outlined below could provide a framework for future action by both the international community and national governments.

A. Using the potential of dual-use technologies

45. There are no "good" or "bad" technologies. The difference between the former and the latter depends on their application. This can be seen in the context of the so-called "dual-use-technologies" which may be applied both for military and civilian purposes. Dual-use technologies relate to the assumption that, for some military technologies, important spin-offs to civilian uses do exist. Such technologies are most likely to be "converted" if useful and commercial applications can be found. The exact potential of dual-use technologies currently applied by the military needs to be explored.

46. The notion of using technologies developed by military R&D to, for example, finding clean and efficient energy production, ways and means to combat desertification, or for profitable space exploration, is particularly intriguing. This report has identified some areas for applying existing military technologies in cleaning up ecological damage. The spectrum of technologies to be explored for their conversion potential includes, for example, information technology, materials, biotechnology and energy. The spectrum of alternative applications ranges from environmental monitoring to cleaning up toxic waste. The full potential of dual-use technology is currently not used and should be given sufficient consideration (see Box 6).

B. Linking conversion initiatives to the needs of developing countries

47. In the discussion of conversion measures, the situation and the needs of developing countries have often not been sufficiently addressed. These include three very different dimensions. First, many developing countries themselves have participated in the arms race in a way that is no longer affordable. Second, some of the most urgent environmental problems are to be found in the developing world, creating a demand for new and efficient environmental technologies. Third, developing countries have had high - but so far unfulfilled - hopes that part of the savings from military spending in the industrial countries would be diverted to accelerate the development process. In this context, the following tasks might be given further consideration: (a) in most developing countries, particular emphasis would have to be given to the retraining of former military personnel and environmentally sound disposal of military hardware; (b) in those countries which have experienced periods of war and conflict, specific measures, such as the removal of land mines, remain unresolved problems which need to be addressed; (c) in developing countries which have a substantial military industrial base themselves, including R&D facilities, alternative ways of promoting high technology in converted or new industries have to be developed;43/ in such cases, conversion needs are often similar to those of the industrialized countries and the economies in transition; (d) particular attention could also be given to technologies likely to stop environmental degradation and desertification and help to clean up existing environmental damage. As regards the latter, the relaxation of security needs with regard to

Box 6

Selected areas of dual-use technology and production processes.

- Ferrous and non-ferrous metallurgy, cintering and bonding;
- Power engineering, electrical engineering, power plant engineering, electrical machine engineering, electric welding;
- Atomic power, atomic energy, nuclear safety, nuclear materials;
- Coal, gas and petroleum engineering;
- Ship building, ship and boat maintenance and retrofitting;
- Heavy and transport engineering, railway and marine transport;
- Chemistry, petrochemistry, chemical machine building;
- Light industry machine building;
- Food, conservation and packaging;
- Special textiles, garment, footwear including manufacturing of exercise and sport goods;
- Agriculture, aquaculture, undersea and sea-bottom engineering (and sciences);
- Aircraft;
- Telecommunications, radio, television;
- Instruments and tool-making design and engineering;
- Optical instrument making, electro-optics engineering;
- New materials;
- Space technology, satellites, related training;
- Engineering potential for alternative product designs in presently unutilized market niches.

(*Source: Paper by Joseph Ben-Dak, UNDP, see endnote 14*)

the diffusion of technologies formerly reserved for military purposes could enhance developing countries' efforts to acquire new technologies that would facilitate the path towards sustainable development. As in the case of environmentally sound technologies, new forms of research partnerships and technology cooperation are needed to address the questions raised above. These will have to include measures to protect intellectual property rights, on the one hand, and to provide developing countries with opportunities to have access to such technologies, on the other hand.

C. Increasing international cooperation

48. As conversion of both military R&D and production is a complex process, often exceeding the capabilities of individual nations, cooperation between countries, strategic alliances between companies at a pre-competitive level, and scientific and technological networks and information exchanges, are an imperative for successful conversion by sharing costs and boosting investments in civilian high technology. Access to technologies is an important issue in this context.

49. Possible activities at the international level to accelerate the process of conversion from military R&D and production to civilian R&D and production could include measures such as: (a) carrying out in-depth studies of environmental technology needs, on the one hand, and existing military R&D and

technologies capable for conversion, on the other hand; (b) assisting countries in defining the political, economic and legal conditions for conversion of scientific and technological capabilities established for military R&D and production; this would include addressing such issues as specific market demands, intellectual property rights and legal arrangements; (c) developing re-training programmes for scientists and engineers from R&D institutes and defence industries, particularly for countries threatened by a "brain-drain" of highly qualified scientific and technical personnel; (d) developing a portfolio of options and a compendium of pilot-projects for directing traditional defence spending to areas such as disaster relief, remote sensing for global environmental programmes, environmentally sound technologies, new and renewable sources of energy, waste management and recycling; and (e) assisting countries to set new priorities in science and technology at the national level with the objective of replacing extensive military R&D with civilian R&D. In this context, consideration could be given to undertaking technology assessments in order to identify adequate military R&D and technologies to be diverted to civilian applications. The international network, Conversion for Sustainable Development (ConverNet) represents an example of such an activity (see Box 7).

Box 7:

ConverNet - An International Network on Conversion for Sustainable Development

The United Nations Conference on "Conversion - Opportunities for Development and Environment", expressed the intention to establish an Information Exchange Network in order to respond to the need for a coordinated international conversion effort. The idea to create a global network for the international efforts on conversion, including the scientific community, was reinforced and elaborated during the United Nations Conferences in Moscow and Hong Kong. The Institute for Environmental Protection (INFU) of the University of Dortmund, Germany, is in the process of developing this communication medium for individuals and organizations. ConverNet is a computer network using the Internet intended to disseminate and exchange information related to conversion and to interchange thoughts, ideas and results that give an impetus to new research fields, topics, or technical projects. ConverNet supports the conversion community by providing tools for easy and quick access to exchange data and information. In the long-run ConverNet intends to provide an international mechanism for monitoring the transfer of know-how and technology in order to maintain an adequate flow of conversion-related technologies to developing countries.

(Source: Dortmund University).

50. In the above context, attention could be drawn to the proposal of the former Costa Rican President and Peace Nobel Laureate, Oscar Arias, to divert a small percentage of funds saved through decreased military expenditures to reward disarmament efforts in - primarily, but not exclusively - developing countries.44/ The Commission might consider any follow-up to this initiative and contribute to such an endeavour by proposing schemes for the conversion of military R&D and by identifying specific areas in which the needs of developing countries should be addressed.

IV. Final remarks

51. The restructuring of the military R&D apparatus is one among other measures to be taken up by the international community and national governments, in order to embark on a sustainable development path. Successful conversion schemes require international cooperation, taking into account the different conditions of individual nations. This cooperation might initially take the forms of workshops and seminars aimed at educating participants on the issues, costs and benefits of conversion. Linking the needs of developing countries to such schemes is an important task for ensuring sustainable development. While dual-use technologies seem to be particularly promising, it is still necessary to identify specific areas for in-depth exploration and to set concrete targets and priorities. Launching a conversion strategy means embarking on a long-term endeavour that goes hand-in-hand with the gradual process of disarmament throughout the world. In this respect, peace, of course, is in itself a dividend important enough to justify disarmament and conversion. Science and technology are significant forces in this process.

Notes

1/ See also: *United Nations Economic and Social Council: Report of the Commission on Science and Technology for Development* on its first session, (E/CN.16/1993/12), 28 May 1993.

2/ *Report of the Trade and Development Board on the first part of its forty-first session*, Geneva, 19-30 September 1994, vol. I (TD/B/41(1)/14), 14 October 1994.

3/ John M. Deutch, Under-secretary of Defense for Acquisition and Technology, Department of Defense, United States of America, in an interview with *Technology Review*, April 1994.

4/ *Ibid*.

5/ United Nations Institute for Disarmament Research: "Science and Technology between Civilian and Military Research and Development", Research Paper No. 7, (UNIDIR 90/97), New York, 1990, p. 20.

6/ *Ibid*. p. 20-21. The original text is to be found in: *Documents on Disarmament 1962, vol. 1*, Washington D.C., 1963, p. 379 (United States Arms Control and Disarmament Agency).

7/ United Nations Centre for Science and Technology for Development, Friedrich-Ebert-Foundation. Draft report on the Panel of Eminent Persons: *Disarmament/Conversion, Climate and Information Technology*, New York, September 1989, p. 1.

8/ United Nations, *Report of the Secretary-General on General and Complete Disarmament: Charting potential uses of resources allocated to military activities for civilian endeavours to protect the environment*, (A/46/364), 17 September 1991.

9/ United Nations, Report of the Secretary-General: *An Agenda for Development: Recommendations*, (A/49/665), 11 November 1994.

10/ For more details see: United Nations Centre for Science and Technology for Development, UPDATE no. 58/Winter 1991/92.

11/ United Nations Centre for Science and Technology for Development, Conference Report, International Conference on *Conversion Opportunities for Development and Environment*, Dortmund, 24-27 February 1992.

12/ United Nations Department of Economic and Social Development *Report of the United Nations Conference on Conversion of the Aerospace Complex - Technology Assessment for Development*, Moscow, 12 - 17 October 1992, New York 1993, (ST/STD/ATAS/Supp. 1).

13/ United Nations Department for Development Support and Management Services: Draft Report, 1993 Hong Kong Conference on *International Cooperation to Promote Conversion from Military to Civilian Industry*, Hong Kong, 7 - 11 July 1993.

14/ See for example, United Nations Development Programme: *The Global Technology Group. Draft, New York, November 1994. See also: Joseph Ben-Dak: Conversion of Military Industries to Civilian Markets and Expectations: A concept for a UNDP contribution.* Draft, 20 April 1992.

15/ The International Labour Office published an extensive series of working papers on the employment dimension of military conversion.

16/ See, for example, United Nations Economic and Social Council, Economic Commission for Europe, Committee on Energy, Steering Committee of the Energy Efficiency 2000 Project - Ad Hoc Meeting on the Conversion of Military Facilities and Manufacturing to the Production of Energy Efficient Technology, Ceska Lipa, 29-31 March 1994. (Energy/AC.11/18), 19 April 1994.

17/ While not currently involved in conversion, the United Nations Environment Programme co-sponsored a programme on "Environmental security" in the early 1990s which also addressed the "*Conversion of Military R&D*". Furthermore, UNEP analyzed the ecological impact of war.

18/ See particularly, United Nations Institute for Disarmament Research (1990), and UNIDIR: *Disarmament, Environment and Development, and their Relevance to the Least Developed Countries*, New York 1991, (UNIDIR/91/83).

19/ The United Nations Industrial Development Organization developed, *inter alia*, a programme for realizing the benefits of new technology spin-offs in developing countries in the light of a relaxation of security restrictions on the diffusion of high technologies from the defence sector.

20/ See, for example, papers presented at the United Nations University Conference on "*Arms reduction and economic development in the post Cold War era*", Tokyo, 4-6 November 1992, to be found in: Lawrence R. Klein, Fu-chen Lo, and Warwick J. Mckibbin: "*Arms Reduction: Economic Implications in the Post-Cold War Era*", Tokyo 1995 (United Nations University Press).

21/ United Nations Institute for Disarmament Research (1990), p. 1.

22/ David Dickson: *The New Politics of Science*, New York 1984 (Pantheon), p. 107.

23/ Colin Norman: "Knowledge and Power: The Global Research and Development Budget", *Worldwatch Paper 31*, Washington D.C. 1979, quoted from Dickson (1984), p. 110.

24/ United Nations Development Programme: *Human Development Report 1994*. New York, 1994, p. 47.

25/ Michael Renner: "*Cleaning up after the Arms Race*" in: *State of the World 1994*, New York, London 1994 (Worldwatch Institute), p. 138. Exact data on the percentage of military R&D out of total R&D expenditures are difficult to obtain from many countries. The OECD estimates this ratio at 5.9 per cent for Japan, 6.5 per cent for Italy, 10.5 per cent for Germany, 24.3 per cent for Sweden, 37.4 per cent for France, 45.1 per cent for the United Kingdom and 58.6 per cent for the United States of America. See: OECD *Main Science and Technology Indicators 1993*, Paris 1994.

26/ United Nations Disarmament Commission, substantive session, New York, 22 April - 13 May 1991, Agenda item 7, *The Role of Science and Technology in the Context of International Security, Disarmament and Other Related Fields*. Working Paper submitted by Colombia, (A/CN.10/156), 30 April 1991.

27/ United Nations Institute for Disarmament Research (1990), p. 17.

28/ United States Congress, Office of Technology Assessment: *"Holding the Edge: Maintaining the Defense Technology Base", OTA-ISC-420*, Washington, D.C. 1989. Quoted from UNIDIR (1990), p. 17.

29/ Herbert Wulf: "*The Dimensions of Conversion*", paper presented at the second meeting of the United Nations University Advisory Team on *Peace and Global Governance*, Barcelona, 24-25 October 1994, p. 9.

30/ S. Frankfurter Allgemeine Zeitung, 1 October 1993.

31/ S. Frankfurter Allgemeine Zeitung, 15 November 1993.

32/ S. Frankfurter Allgemeine Zeitung, 1 July 1994.

33/ Detailed data on China and Russia to be found in Michael Renner, *"Swords into Plowshares: Converting to a Peace Economy", Worldwatch Paper No. 96*, Washington D.C., June 1990 and in: Michael Renner, *"Economic Adjustment after the Cold War"*, Aldershot 1992 (a UNIDIR publication).

34/ See report of the Ad Hoc Working Group on the Interrelationship between Investment and Technology Transfer (E/CN.16/1995/10) and the report of the Panel of Experts on the Contribution of Technologies including New and Emerging Technologies to the Industrialization of Developing Countries (E/CN.16/1995/8).

35/ University of Dortmund, internal memorandum by the Rector on the issue of military research, 15 March 1991 (translation from German text).

36/ Dickson (1984), p. 110.

37/ United Nations, A/46/364 (*op. cit*), p. 47.

38/ *Ibid*., p. 30.

39/ Compare the detailed proposals in United Nations document A/46/364 of 17 September 1991, *op. cit*.

40/ J. M. Cadiou: "*Clean-up of the cold war legacy*", presentation at the International Workshop on Remediation of Contaminated Military Sites in Berlin, 20-22 September 1993. See also *NATO Newsletter*, issue No. 42, 4th quarter 1994.

41/ United Nations Institute for Disarmament Research: "*Economic Aspects of Disarmament: Disarmament as an Investment Process*", New York 1993, (UNIDIR/92/94), p. 5. Ample evidence of such needs also appears in the report of the Panel on Technologies for Small-Scale Economic Activities to Address the Basic Needs of Low-Income Populations (E/CN.16/1995/2) and the report of the Panel on Science and Technology Aspects of the Sectoral Issue to be discussed by the Commission on Sustainable Development (E/CN.16/1995/4).

42/ C.f. United Nations Institute for Disarmament Research (1993), p. 29.

43/ *Ibid*. p. 63-64.

44/ For details of the proposal, see United Nations Development Programme (1994), p. 59.